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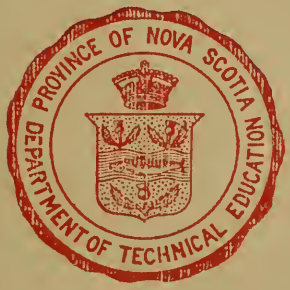
MAIN STORAGE
Engineering

Dept of Civil Engineering

Nova Scotia Technical College

CALENDAR



Halifax, N. S.

1909/1910

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UNIVERSITY OF TORONTO

CALENDAR.

1909.

September 4, Saturday, Registration for Civil Engineering Summer Camp.

September 6–25, Civil Engineering Summer Camp.

September 27, Monday, Registration.

September 28, Tuesday, Lectures begin.

November——, Thursday to Saturday, Thanksgiving vacation.

December 24, Friday, Christmas vacation.

1910.

January 4, Tuesday, class work resumed.

January 24, Monday, Mid-year Examinations begin.

February 2, Wednesday, Second Semester begins.

March 25–28, Friday to Monday, Easter Recess.

May 16, Monday, Final Examinations begin.

May 23, Monday, Commencement.

May 25, Wednesday, Summer vacation begins. Summer Mining School begins.

June 22, Summer Mining School ends.

PROVINCE OF NOVA SCOTIA.

COUNCIL OF PUBLIC INSTRUCTION.

Hon. G. H. Murray, M. P. P., Premier and Provincial Secretary.
Hon. W. T. Pipes, M. L. C., Attorney General.
Hon. C. P. Chisholm, M. P. P., Commissioner of Public Works and Mines.
Hon. David McPherson, M. P. P.
Hon. H. S. LeBlanc, M. P. P.
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NOVA SCOTIA TECHNICAL COLLEGE.

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Rev. H. P. McPherson, D. D. University of St. Francis Xavier College.
Prin. F. H. Sexton, Nova Scotia Technical College.
Prof. T. S. Hewerdine, Nova Scotia Technical College.
Prof. R. R. Keely, Nova Scotia Technical College.

NOVA SCOTIA TECHNICAL COLLEGE.

STAFF.

F. H. Sexton, S. B., Principal and Prof. of Mining and Metallurgy.
R. R. Keely, M. E., E. E., M. M. E., Prof. of Electrical and Mechanical Engineering.
T. S. Hewerdine, A. B., S. B., Prof. of Civil Engineering.
G. F. Murphy, B. E., Instructor in Mining and Metallurgy.
H. Piers, Librarian and Curator of the Museum.
M. J. McCurdy, Secretary.

GENERAL STATEMENT.

FOUNDATION AND PURPOSE.

The Nova Scotia Technical College was established by the passing of "An Act Relating to Technical Education" on the 25th day of April, 1907, by the Governor, Council and Assembly of Nova Scotia.

The aims and scope of this institution are outlined in the Public Statutes of Nova Scotia, 1907, Chapter 1, Sections 5—11.

"5. There shall be established at Halifax an institution for the purpose of affording facilities for scientific research and instruction and professional training in civil, mining, mechanical, chemical, metallurgical and electrical engineering or any other departments which may from time to time be added.

"6. The institution shall be called the Nova Scotia Technical College.

"7. The Governor-in-Council is hereby authorized to borrow a sum not exceeding $100,000 and to expend the same in securing a site, erecting a building and providing adequate apparatus, plant, books, materials and appliances for the purposes of said institution.

"8. The Council of Public Instruction may from time to time make such rules and regulations as it deems expedient for the efficient conduct of the said institution, and may amend or repeal the same.

"9. The Director of Technical Education shall be the principal of the said institution.

"10. The Council of Public Instruction shall, upon the recommendation of the principal, appoint such professors and instructors as the Council considers requisite for the purposes for which the institution is established.

"11. (1) The members of the teaching staff of the institution, having the rank of professors, and such representa-

tive of any university of the province or elsewhere as the Council may select shall constitute a body corporate, under the name of the Nova Scotia Technical College.

"(2) The said corporation shall have power to grant such degrees as it may determine, to prescribe the several qualifications therefor, the course of study to be pursued in the several departments, and in respect to all matters of discipline and all matters connected with the educational work of the institution shall have the conduct and control thereof.

(3) In the event of any part or parts of the course of study prescribed for the first and second years being included in the educational work done in the universities recognized by the Council in this province or elsewhere, the Council of Public Instuction shall exclude such parts from the course of study of the said institution."

At the session of the Provincial Legislature in 1908-9, an additional $100,000 was voted for the construction and equipment of engineering laboratories.

Engineering Building.

The main building of the Technical College which contains the lecture rooms, science laboratories, museum, library, gymnasium, and assembly hall is now practically completed. It is an imposing building of pressed red brick and freestone, erected on the military property adjoining the Court House on Spring Garden Road, in Halifax. This main structure is 146 feet long, 48 feet wide, and has two wings 41 by 52 feet each.

In the basement, room is provided for a work shop, fan room, store room, assaying laboratory, balance room, metallography laboratory, locker room, cement laboratory and gymnasium.

The first floor contains the administrative offices, museum curator's office, geological laboratory, lecture rooms, electrical

measurements laboratory, electrical research laboratory and heat laboratory.

On the second floor are the staff offices, library, chemical laboratory, chemical research laboratory, two lecture rooms, drafting room and large assembly hall. The building has a steel frame, reinforced concrete floors and is of slow burning construction throughout.

Engineering Laboratories.

Plans are now being prepared for the erection of a power house, mechanical and electrical engineering laboratory, hydraulic laboratory, materials testing laboratory, machine shop and mining and metallurgical laboratory.

College Government.

The governing functions of the Nova Scotia Technical College are vested in a Board of Governors and the Council of Public Instruction. The Board of Governors consists of one member nominated by each of the five recognized and affiliated colleges and universities in the Maritime Provinces, together with the professors of the teaching staff of the Technical College.

This Board makes all regulations in regard to admission requirements, general curriculum, and other matters which concern the general standard and welfare of the College. The Board of Governors is under the supervision and control of the Council of Public Instruction and all regulations made by the former body must receive the ratification of the latter.

Affiliation.

The Nova Scotia Technical College is affiliated with the following universities,—Acadia, Dalhousie, King's, Mt. Allison, and St. Francis Xavier. By the terms of the affiliation, the separate universities offer a uniform course in engineering

covering the first two years and the Technical College offers professional courses in several departments of engineering covering the last two years' course. Students from the separate universities are admitted to the Technical College on certificate without examination under certain conditions enumerated later. The matriculation requirements for entrance into the uniform engineering course of the separate colleges are also uniform and are to be found in a succeeding paragraph.

Admission to the First two Years Engineering Course in the Affiliated Universities.

Applicants for admission must have attained the age of 16 years. Persons seeking admission must give satisfactory evidence of proficency by examination or certificate in the following subjects:

Entrance requirements for engineering into all recognized colleges in Nova Scotia and Mount Allison in New Brunswick.

1. *Arithmetic and Algebra.*
   Arithmetic,
   Algebra as in Hall and Knight's Elementary Algebra excepting Chap. 41.
2. *Geometry and Trigonometry:*
   Geometry: Euclid, Books I to VI, inclusive.
   Trigonometry: As in Murray's Plane Trigonometry, Chaps. I to VIII, or equivalent; or Practical Mathematics as in Grade XI.
3. *English:*
   As in Grade XI or equivalent.
4. *French or German:*
   As in Grade XI or equivalent.
5. *History:*
   As in Grade XI or English and Canadian History.

6. One of the following:
   (a) *Latin*, as in Grade XI or equivalent.
   (b) *Greek*, as in Grade XI or equivalent.
   (c) Additional work equivalent to that required for Grade XII in the language chosen as *Subject 4*.
   (d) *Mechanical Drawing:* Projection of points, lines, plane figures, and simple solids; dimensioned sketches of simple machine parts; lettering and dimensioning of drawing neatly and accurately done.

NOTE.—In all cases where mechanical drawing is offered, as in No. 6 (d), all the plates must be submitted together with certificates stating where the drawing was done.

REGULATIONS FOR CONDITIONED STUDENTS.

The following regulation has been adopted by the Governing Board for those applicants who do not attain the required proficiency in every matriculation subject.

No student who has been conditioned in more than one subject of matriculation shall be admitted to the full work of the first year of the engineering course, and all matriculation conditions must be removed before a student enters upon the second year of the course.

This regulation *does not mean* that a person who is conditioned in more than one subject cannot go to a college and begin to study for the engineering course. It *means* that such a person will not be considered a *full first year student* and will probably have to take two years at that College in preparing to enter the second year of the engineering course. It *does mean* also that a student must not have any matriculation conditions in entering the second year of the course.

Advance of Requirements for Admission to the First Two Years' Engineering Course.

The Advisory Board of Education and the Council of Public Instruction at the present time are considering important modifications of the High School Course in Grade XII and the desirability of requiring this grade for entrance into the first two years' engineering course in the affiliated Universities. Due notice will be given of an advance in the requirements at least one year before they go into effect. It is highly probable, however, that the new Grade XII course will be required for matriculation in the autumn of 1911.

Admission to the Technical College.

Applicants must have attained the age of eighteen years.

The students who enter the Technical College will be classified as regular or special. Regular students will be those who are candidates for degrees, and special students are those who voluntarily, or by reason of not having passed all requirements, are taking special courses.

Admission to the Technical College will be on certificate from the properly authorized officer of the University at which the student has pursued his first two years' engineering course. This certificate must state the subjects taken, the marks made in each subject, and the pass mark required at that University in engineering courses.

Regular students will be admitted to the Technical College who have secured the required proficiency in ALL THE COURSES of the first two years Engineering Course as hereafter outlined.

Special Students shall not be permitted to take more than three subjects simultaneously.

Note:—The following temporary exception has been adopted:

In 1909, regular students will be permitted to enter the Technical College who are CONDITIONED IN ONE SUBJECT ONLY of the first two year's course, provided that that subject is not one of the following:

Mathematics, Physics, Chemistry, Surveying, or Drawing. The right, however, is reserved to exclude as a regular student anyone who has failed in any other subject of the preliminary course than those specified above.

ADMISSION TO ADVANCED STANDING IN THE TECHNICAL COLLEGE.

Any person may be admitted to advanced standing in the Technical College by passing such examinations as are deemed necessary by the college faculty or by submitting such certificates of previous records of study or experience as shall satisfy the faculty. All applicants for special examinations for advanced standing must be made to the principal of the college before September 1st, 1909.

ADMISSION TO SPECIAL CLASSES IN THE TECHNICAL COLLEGE.

Any person on the payment of the required fee and the production of evidence to the faculty of sufficient knowledge and training to benefit by the instruction in any separate class or classes given in the Technical College, may enter and pursue such class or classes as a special student.

DEGREES.

To whomsoever shall satisfactorily acquire the requisite proficiency in all the regular courses of either Civil, Mining, Mechanical or Electrical Engineering as prescribed in this calendar shall be given by the Technical College a degree of Bachelor of Science in that department in which he has pursued his studies.

Certificates.

Anyone attending one or more classes in the Technical College and attaining the requisite standard of proficiency in aid class or classes shall, on application, receive a certificate attesting to the exact work done.

Tuition, Fees, Deposits, Etc.

The tuition for instruction in any regular department of engineering shall be seventy-five dollars ($75) per year, forty dollars of which shall be paid within one month of the opening in September and the remainder during the first month of the second term which begins usually in February.

To those who are attending special classes the fees are as follows:—

For any single course for one-half year, seven and one-half dollars ($7.50).

For any single course for one whole year, twelve dollars ($12.00).

For two or more half or whole year's courses, the fees shall be determined by the Faculty.

Small deposits shall be required of all students taking laboratory classes on entrance to the same to cover breakage. An itemized account of supplies used by students will be rendered at the end of the year for settlement.

Scholarships.

There is one free scholarship of a value of seventy-five dollars ($75.00) for each of the eighteen counties of Nova Scotia except the counties of Halifax and Cape Breton, for which there are two free scholarships each. These scholarships are to be awarded on the basis of need and merit after the results of the mid-year examinations. The applicants for scholarships must have been bona fide residents for three years in the county for

the scholarships for which they are seeking. If there is no applicant in any one year for a certain scholarship, a student resident in any other county for three years previous may by permission of the Faculty apply for the vacant scholarship and may be awarded the same by the Faculty.

FIRST TWO YEARS' UNIFORM ENGINEERING COURSE IN THE AFFILIATED UNIVERSITIES.

I. MATHEMATICS, (*First and Second years*):—

1. *Algebra*: Higher Algebra including graphs 72 hours.
2. *Trigonometry*: As in Murray's Plane Trigonometry ..... 18 hours.
3. *Solid Geometry* ..... 24 hours.
4. *Analytical Geometry* ..... 60 hours.
5. *Calculus*: Differential and Integral ..... 90 hours.

II. CHEMISTRY, (*First year*):—

1. *General Chemistry*: Lectures ..... 72 hours.
2. *General Chemistry*: Laboratory ..... 90 hours.

III. ENGLISH ..... 72 hours.

IV. FRENCH OR GERMAN: (One third of time to be devoted to Technical Literature) 72 hours.

V. DRAWING: *Mechanical* and *Freehand* ... 192 hours.

VI. WORKSHOP: ..... 144 hours.

NOTE:—Workshop for Mechanical and Electrical Engineers will consist of woodwork and pattern-making. Work-shop for Civil and Mining Engineers will consist of joinery, pattern-making, iron turning and forge work.

(Second Year.)

II. PHYSICS, (*including Mechanics, Electricity, Light and Sound*):—

1. Lectures and Recitations ..... 96 hours.
2. Laboratory ..... 72 hours.

III. CHEMISTRY (*Qualitative Analysis*):—

1. Lectures ..... 24 hours.
2. Laboratory ..... 96 hours.

IV. Surveying :—
1. Lectures. ..... 24 hours.
2. Field and Laboratory work ..... 48 hours.
V. English, (Literature and Composition).... 48 hours.
VI. Either A, B or C according to the course.
A. [For Civil Engineering].
1. *Descriptive Geometry*: Lectures, Recitation and Drawing ..... 72 hours.
2. *General Geology:* Lectures..... 48 hours.
Laboratory..... 48 hours.
Field work (minimum during the open season) ..... 24 hours.
3. Mapping, Topographical Drawing and Field work..... 48 hours.
B. For Mining Engineering]
1. *Geology*: General Geology as in A.
2. *Mineralogy*: Recitation and Laboratory. 72 hours.
3. *Surveying:* As in A.
C. [For Mechanical and Electrical Engineering].
1. *Descriptive Geometry:* As in A.
2. *Machine Drawing and Design:* Drafting. 72 hours
3. *Workshop,*..... 96 hours

Engineering Camp.

A united engineering camp for students between the second and third and the third and fourth years, will be held in the vicinity of Cox's Lake and Hammond's Plains, Halifax County, September 6th to 25th, 1909. There will be required a deposit of fifteen dollars ($15) for this class.

SHORT COURSES.

It is the intention of the Technical College, to offer short courses in the various departments of engineering for those who cannot afford to take four whole years to acquire a regular

degree. These short courses will be moulded to fit the demands of the present industrial conditions. Thus it is planned to offer a short course in Civil Engineering that shall be adapted to the needs of road builders and road inspectors; another for provincial land surveyors; another in mechanical engineering for stationary and marine engineers; another in mining engineering for colliery officials, etc. The scope of the work and the time for the sessions is still to be determined and will be announced later.

Equipment.

The following laboratories are being equipped in a thoroughly up-to-date manner:

Mining Laboratory.
Metallurgical Laboratory.
Strength of Materials Laboratory.
Hydraulics Laboratory.
Electrical Engineering Laboratory.
Thermodynamics Laboratory.
Chemistry Laboratory.
Assaying Laboratory.
Machine Shop.

A central power station for heating and lighting is also being installed which will contain steam and electrical machinery of commercial size units for illustration and testing purposes as well as for actual use.

The Provincial Science Library and Museum are to be moved from their present habitation to commodious quarters at the Technical College. The Science Library has a splendid collection of standard scientific works and periodicals and the Museum possesses a remarkably complete collection of ores and minerals which will be available for class use.

DEPARTMENT OF CIVIL ENGINEERING.

The courses offered in this department are for two years of purely technical work. This presupposes at least two years of strong college, or University training, which must include certain scientific or technical subjects. Further information concerning the entrance requirements is fully stated elsewhere in this catalog. Although realizing the desirability of including certain other courses, for their cultural value, it is deemed wisest to adhere to work of a strictly engineering character.

The new buildings and laboratories equipped with the latest and most carefully selected apparatus, and also a strong technical library afford ample facilities for tests, research and original investigations.

It is proposed to maintain a high standard of efficiency, equivalent to that of older technical colleges, and universities. The methods of instruction involve lectures, recitations, assigned readings, laboratory and field work, designing, visits to existing structures, with written reports. It is intended to give the student information and practice which will be of direct value in his future professional work, but the highest aim is to encourage independent thinking and investigation, that he may more fully realize his own powers, and be better able to meet the new problems and conditions that may arise in his engineering experience.

101. MECHANICS OF ENGINEERING, I.

THIRD YEAR, FIRST SEMESTER, FIFTEEN WEEKS, FIVE HOURS PER WEEK.

Prerequisite: Third year entrance requirements.

Recitations in statics, dynamics, and mechanics of materials; with graphic and analytic solutions of problems.

TEXT:

Maurer—"Technical Mechanics."

102. MECHANICS OF ENGINEERING, II.

THIRD YEAR FIRST NINE WEEKS OF THE SECOND SEMESTER FIVE HOURS PER WEEK

Prerequisite: 101.

A continuation of the study of the mechanics of materials begun in course 101, also a study of engineering materials and the elastic limits, working stresses, and ultimate resistances of cast iron, wrought iron, steel, timber, stone, etc. Laboratory work accompanies this course. (See 103.)

TEXT:

Merriman—"Mechanics of Materials."

103. MATERIALS TESTING.

THIRD YEAR, SECOND SEMESTER, FIFTEEN WEEKS, ONE THREE-HOUR LABORATORY PERIOD PER WEEK. CONCURRENT WITH NO. 102

Testing wrought iron, cast iron, steel and wood, in tension in compression, transversely, in shear: torsion tests, bending tests, tests of riveting, concrete beams, etc.

105. GRAPHIC STATICS.

THIRD YEAR, LAST SIX WEEKS OF THE SECOND SEMESTER, FIVE HOURS PER WEEK

Prerequisite: No. 101.

A study of the general principles of the force and equilibrium polygons: and the application of these principles in the determination of stresses in framed structures, of shear and bending moment in beams.

TEXT:

Ketchum—"Steel Mill Buildings."

111. THEROETICAL HYDRUALICS.

THIRD YEAR, FIRST NINE WEEKS OF THE SECOND SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: No. 101.

A consideration of the theory of the pressure and flow of water and its measurement. The design, construction and use of pumps, rams, propellors, turbines, and other types of water wheels. This course is accompanied by laboratory work. (See 112.)

TEXT AND REFERENCES:

Unwin—"Treatise on Hydraulics."

Merriman—"Treatise on Hydraulics."

112. HYDRAULIC TESTING.

THIRD YEAR, SECOND SEMESTER, FIFTEEN WEEKS, ONE THREE-HOUR PERIOD PER WEEK. CONCURRENT WITH 111.

Experiments for determining the discharge of water through pipes, orifices, weirs; also efficiency tests on the ram, turbine, Pelton Wheel, etc.

120. ADVANCED SURVEYING.

THIRD YEAR, FIRST SEMESTER, FIFTEEN WEEKS, THREE THREE-HOUR PERIODS PER WEEK.

Prerequisite: Third year entrance requirements.

Geodosy; Electric railway surveys with maps, designs and estimates of cost.

Designs of railway special work and other simple railroad structures. Also, a completion of the office work of the previous summer's camp.

121. RAILWAY LOCATION.

THIRD YEAR, FIRST SIX WEEKS OF FIRST SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: Third year entrance requirements.

A course of lectures and recitations on the principles of economic location of steam and electric railways, and a study of field methods. This is accompanied by some field work (See course No. 120); and followed by a complete survey of a railway line, while in camp the following summer, (See course No. 125.)

TEXT AND REFERENCE BOOKS:

Allen—"Railroad Curves and Earthwork."

Wellington—"Economic Theory of Railway Location"

Talbot—"Railroad Transition Spiral."

122. RAILWAY CONSTRUCTION AND MAINTENANCE.

THIRD YEAR, FIRST SEMESTER, LAST NINE WEEKS, FIVE HOURS PER WEEK.

Prerequisite: No. 121.

This course of lectures and recitations consists of a study of materials and equipment of steam and electric railways; methods and costs of construction and maintenance.

TEXTS AND REFERENCE BOOKS:

Camp—"Notes on Track."

Raymond—"Elements of Railway Engineering.

Wellington—"Economic Theory of Railroad Construction."

123. RAILWAY FIELD WORK.

Three weeks of field work in camp in September, preceding both the third and fourth years. The class follows the methods of modern practice; reconnaissance, preliminary and location surveys; cross-sectioning; staking out of earthwork, etc.

TEXTS:

Allen—"Railroad curves and Earthwork."
Allen—"Field and Office Tables."
Talbot—"Railroad Transition Spiral."

124. RAILWAY STRUCTURES.

FOURTH YEAR, FIRST SEMESTER, FIRST $7\frac{1}{2}$ WEEKS, SIX HOURS PER WEEK.

Prerequisite: Nos. 121, 122, 123.

The office work of the previous summer's field work is completed. This is followed by drawings of the details of railway structures and problems in original design.

125. TUNNELING.

FOURTH YEAR, SECOND SEMESTER, TENTH, ELEVENTH, AND TWELTH WEEKS, FIVE HOURS PER WEEK.

Prerequisite: Nos. 301, 102, 111, 141.

This course consists of lectures, recitations, and assigned readings on the principles of tunneling, and the methods employed on some recently constructed tunnels.

TEXTS AND REFERENCE BOOKS:

Stauffer—"Modern Tunnel Practice."
Sims—"Practical Tunneling."

131. ROADS AND PAVEMENTS.

THIRD YEAR, LAST SIX WEEKS OF SECOND SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: Third year entrance requirements.

Lectures and recitations; assigned readings and reports.

The economic justification for the improvement of highways. The theory of location of roads and streets and study of the various types of roads and pavements as to durability,

desirability, materials, principles, details, cost and methods of construction and maintenance.

TEXT AND REFERENCE BOOKS:

Baker—"Roads and Pavements."
Byrne's—"Highway Construction."
Judson's—"City Roads and Pavements."

141. MASONRY CONSTRUCTION.

FOURTH YEAR, FIRST SEMESTER, FIFTEEN WEEKS, FIVE HOURS PER WEEK.

Prerequisite: Nos. 102, 105, 111, 120.

Lectures and recitation, accompanied by laboratory work. (see 142,) and followed by designing (see 143).

A study of the materials of masonry construction; the mechanics of masonry structures, and reinforced concrete; foundations; coffer dams, dams, caissons, piers, abutments, retaining walls, arches, etc.

TEXTS AND REFERENCE BOOKS:

Baker—"Masonry Construction."
Patton—"Foundations."
Taylor-Thompson—"Concrete, Plain and Reinforced."
Fowler—"Ordinary Foundations."
Schuyler—"Reservoirs for Irrigation and Water Power."

142. MATERIALS TESTING.

FOURTH YEAR, FIRST SEMESTER, FIFTEEN WEEKS, ONE THREE-HOUR LABORATORY PERIOD PER WEEK.

This accompanies masonry construction (see course 141.) The work consists principally of cement testing and experiments.

143. MASONRY AND REINFORCED CONCRETE DESIGN.

FOURTH YEAR, FIRST FOUR WEEKS OF SECOND SEMESTER, TWENTY-FOUR HOURS PER WEEK.

Prerequisite: No. 141.

In this course each student makes a complete design, drawing, tracing and blueprint of a reinforced concrete arch; a voussoir arch; a high dam; and a retaining wall.

151. WATER SUPPLY.

FOURTH YEAR, FIRST SEMESTER, LAST NINE WEEKS, FIVE HOURS PER WEEK.

Prerequisite: Nos. 102, 111, 301.

This course consists of lectures, recitations, assigned readings, problems and reports.

A study of the principal features of municipal water supply systems, their design and construction; including source and methods of supply, pumps and machinery, tests of purity, storage and system of distribution.

TEXTS AND REFERENCE BOOKS:

Turneaure and Russell—"Public Water Supplies."
Folwell—"Water Supply Engineering."
Hazen—"Filtration of Public Water Supply."
Fanning—"Water Supply Engineering."

152. WATER SUPPLY DESIGN.

FOURTH YEAR, FIRST SEMESTER, LAST SEVEN AND ONE HALF WEEKS, TWO DRAFTING ROOM PERIODS OF THREE HOURS EACH PER WEEK.

Concurrent with No. 151. Design of stand-pipe or elevated tank; a water supply distribution system.

153. HYDRAULIC ENGINEERING.

FOURTH YEAR, FIRST NINE WEEKS OF SECOND SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: No. 111.

A course of lectures, recitations, assigned readings and reports on hydraulic development for purposes of irrigation, power and transportation; including the design and construction of irrigation works, canals, levees, river improvements, etc.

TEXTS AND REFERENCE BOOKS:

Mead—"Water Power Engineering."
Frizell—"Water Power."
Wilson—"Irrigation Engineering."

161. SEWERAGE.

FOURTH YEAR, FIRST NINE WEEKS OF THE SECOND SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: Nos. 102, 111, 151.

This course consists of lectures, recitations, assigned readings and reports. A study is made of the various systems, designs, sewer appurtenances; methods and cost of construction.

TEXTS AND REFERENCE BOOKS:

Folwell—"Sewerage."
Ogden—"Sewer Design."
Ogden—"Sewer Construction."
Moore—"Sanitary Engineering."

162. SEWAGE DISPOSAL AND GENERAL SANITATION.

FOURTH YEAR, SECOND SEMESTER, LAST SIX WEEKS, FIVE HOURS PER WEEK.

Prerequisite: No. 161.

This is a continuation of 161, in which a special study is made of the methods of sewage and garbage disposal; with lectures, assigned readings and reports on other sanitary matters.

TEXTS AND REFERENCE BOOKS:

Raikes—"Sewage Disposal Works."

Rideal—"Sewage."

Venable—"Garbage Crematories."

Venable—"Methods and Devices for Bacterial Treatment of Sewerage."

163. SEWER DESIGN.

FOURTH YEAR, SECOND SEMESTER, LAST TWO WEEKS, TWENTY-FOUR HOURS PER WEEK.

Prerequisite: No. 161.

Design of a sewerage system, with estimate of cost of construction.

171. ROOFS AND BRIDGES.

FOURTH YEAR, FIRST SIX WEEKS OF THE FIRST SEMESTER, FIVE HOURS PER WEEK.

Prerequisite, Nos. 102, 105.

This course consists of lectures and exercises in the algebraic and graphic methods of computing stresses in bridge and roof trusses, plate girders, viaducts, etc.

This work is taken with course 172.

TEXT AND REFERENCE BOOKS:

Ketchum—"Steel Mill Buildings."

Merriman and Jacoby—"Roofs and Bridges."

Johnson, Bryan and Turneaure—"Modern Framed Structures."

172. ROOFS AND BRIDGES.

FOURTH YEAR, FIFTEEN WEEKS FIRST SEMESTER, SIX HOURS PER WEEK.

Taken with course 171.

This course consists of two drafting room periods of three hours each, also visits to bridges where sketches are made of details and afterwards drawn to scale. Designs and working drawings of a plate girder and a highway bridge with estimates of costs.

173. BRIDGE DESIGN.

FOURTH YEAR, SECOND SEMESTER, FIFTH TO THIRTEENTH WEEK, INCLUSIVE, TWENTY-FIVE HOURS PER WEEK.

Prerequisite, 171, 172.

In this course each student designs and prepares working drawings, tracings and blueprints of a railway truss and an estimate of cost.

TEXT AND REFERENCE BOOKS:

Merriman and Jacoby—"Roofs and Bridges."

Johnson—"Framed Structures."

181. ENGINEERING TOPICS.

Students will make reports on assigned topics at the meetings of the Engineering Society. The reading of the report will be followed by a general discussion open to students of all departments and classes.

191. CONTRACTS AND SPECIFICATIONS.

FOURTH YEAR, LAST THREE WEEKS OF THE SECOND SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: All preceding work of the fourth year.

This course consists of lectures on the law of contracts by prominent attorneys; and a critical study of the form and matter of specifications for engineering constructions.

201. ELECTRICAL MACHINERY.

THIRD YEAR, FIRST AND SECOND SEMESTER, THREE HOURS A WEEK.

This is a course of three recitations per week. Topics considered are: History of the development of dynamo-electric machinery; definitions of dynamo, motor, magnetic field, magneto-motive force, hysteresis etc. Materials used by the electrical engineer, parts of the dynamo and the general consideration of circuits, transformers, motor generators, constant and variable currents and the general effect on an electric circuit of variable current; theory and characteristics of direct current generators and motors, including series, shunt and compound wound machines; the theory of commutation, speed control of motors, and a discussion of the principles of testing electric machinery.

TEXT BOOK:

Norris—"Elements of Electrical Engineering."

REFERENCES:

Sheldon—"Dynamo-Electric Machinery."

S. P. Thompson—"Dynamo-Electric Machinery."

J. A. Ewing—"Magnetic Induction of Iron and other Metals."

Reid—"Elementary Electrical Engineering."

Crocker—"Electric Lighting," Vols. I and II.

Franklin and Esty—"Elements of Electrical Engineering."

210. ELECTRICAL ENGINEERING LABORATORY.

THIRD YEAR, FIRST AND SECOND SEMESTER, TWO THREE-HOUR PERIODS A WEEK, TWO HOURS CREDIT.

A series of experiments to accompany course No. 201. Its purpose is to illustrate the fundamental principles and to give the student practice in operating and testing electrical machinery The first experiments are in the construction and use of electric measuring instruments followed by a study of methods and practice in testing motors, generators, converters, motor generators, constant current machines and arc and incandescent lamps.

TEXT BOOKS:

Karapetoff—"Laboratory Manual."

301. THERMODYNAMICS.

THIRD YEAR, FIRST SEMESTER, FIVE HOURS A WEEK LECTURES AND RECITATIONS.

This course in heat is considered one of the fundamentals of engineering and great stress is laid on the thorough mastery of its laws.

The elementary laws of heat and its effect are studied; the general laws of thermodynamics; theoretical heat engines; isothermal and adiabatic expansion; the application of the laws to the steam and other engines; the principles governing the transfer of heat from gases to water.

TEXT:

Ewing's—"Steam Engine."

REFERENCE:

Geberhardt—"Steam Power Plant Engineering.'
Benjamin—"Heat and Steam."
French—"The Steam Turbine."
Hutton—"Steam Engines."

Stodola—"Steam Turbine."
Peabody—"Thermodynamics of Steam Engineering."
Ripper—"Steam Engine."

310. MECHANICAL ENGINEERING LABORATORY.

THIRD YEAR, FIRST AND SECOND SEMESTER, THREE HOURS A WEEK.

A course of testing indicators and gauges, steam and gas and gasoline engines, dynamometers and the measurement of power, pyrometers and the measurement of heat; calorimeters for steam and gas; pumping machinery and hydraulic motors.

REFERENCE:

Carpenter's—"Experimental Engineering."

405. APPLIED GEOLOGY, See p. 54

410. METALLURGY OF IRON AND STEEL.

SHORT COURSE FOR CIVIL, MECHANICAL AND ELECTRICAL ENGINEERS. See p. 39.

DEPARTMENT OF ELECTRICAL ENGINEERING.

As announced elsewhere, the first two years of this course are given in the affiliated colleges. The course as herein described covers the third and fourth years. The plan is to give a broad and thorough training in the theory and practice of electricity and mechanical principles, and their application to engineering work.

Text books are used when a book can be found covering the course which it is desired to teach. The work is carried on by lectures and recitations in conjunction with the laboratory courses.

Students who take this course should have a natural interest in machinery of all kinds, and should be well grounded in mathematics and physics.

In the third year the theory, design and operation of constant and variable current machinery is studied. The theory is taught by lectures and recitations in class, in conjunction with operating and testing actual machines in the laboratory. It is intended, however, to give only sufficient laboratory work to illustrate and to impress upon the mind of the student the theory as taught in the text.

The electrical laboratories are designed and especially well adapted for the work as outlined in this course. The equipment is all new and selected with great care. Because of this fact, it is expected that as good work will be done as in some of the larger colleges with larger but less modern equipment.

201. ELECTRICAL MACHINERY.

THIRD YEAR, FIRST AND SECOND SEMESTER, THREE HOURS A WEEK.

This is a course of three recitations per week. Topics considered are ; History of the development of dynamo electric

machinery; definitions of dynamo, motor, magnetic field, magneto-motive force, hysteresis, etc; materials used by the electrical engineer; parts of the dynamo and the general consideration of circuits, transformers, motor generators; constant and variable currents and the general effect on an electric circuit of a variable current; theory and characteristics of direct current generators and motors, including series, shunt and compound wound machines: the theory of commutation, speed control of motors, and a discussion of the principles of testing electric machinery.

TEXT BOOK:

Norris—"Elements of Electrical Engineering."

REFERENCE BOOKS:

Sheldon—"Dynamo Electric Machinery."

S. P. Thompson—"Dynamo Electric Machinery."

J. A. Ewing—"Magnetic Induction of Iron and other Metals."

Reid—"Elementary Electrical Engineering."

Crocker:—"Electric Lighting," Vols. I & II.

Franklin & Esty:—"Elements of Electrical Engineering."

202. ALTERNATING CURRENTS & MACHINERY.

FOURTH YEAR, FIRST AND SECOND SEMESTERS, FIVE HOURS A WEEK.

This course is a continuation of 201 and deals more at length with the theory of alternating circuits and applications to engineering practice, familiarizing the student with current practice in generators and motors, transformers, and rotary convertors.

TEXTS AND REFERENCE BOOKS:

Franklin and Esty—"Elementary Electrical Engineering Alternating Currents."

Crocker—"Electric Lighting," Vols. I and II.

Steinmetz—"Electrical Engineering."
McAllister—"Alternating Current Laboratory."
Thompson—"Dynamo Electric Machinery."
Sheldon and Mason—"Alternating Current Machinery."

203. ELECTRICAL ENGINEERING ABSTRACTS.

THIRD AND FOURTH YEARS, FIRST AND SECOND SEMESTERS, ONE HOUR PER WEEK.

The students meet once a week for an hour to discuss current magazines, bulletins from manufacturers, proceedings of the Engineering Societies, late inventions and items of general interest to the Engineer.

Reports on various assigned topics will be required.

205. ELECTRICAL DISTRIBUTION.

FOR MECHANICAL AND ELECTRICAL ENGINEERS, FOURTH YEAR THREE HOURS CREDIT LAST NINE WEEKS FIRST SEMESTER, AND FIRST EIGHT WEEKS SECOND SEMESTER.

This course deals with the transmission of power by means of electrical energy; fundamental problems in transmission line design; conditions effecting choice of apparatus; line voltage, etc. A study will be made of certain leading transmission systems which are at present in operation with a view of ascertaining the reasons for selecting such apparatus and the effect on the result had another system been chosen.

REFERENCE:

Crocker—"Electric Lighting."
"Standard Handbook for Electrical Engineers."
Thompson—"Dynamo Electric Machinery."
Lyndon—"Development and Electrical Distribution of Water Power."

206. ELECTRIC RAILWAYS.

FOURTH YEAR, ELECTRICAL ENGINEERS, SECOND SEMESTER, LAST SIX WEEKS, FIVE HOURS A WEEK, TWO HOURS CREDIT.

Study of conditions effecting choice of apparatus; power requirements, cars and car equipments, track construction, bonding, testing, etc. and distribution systems.

TEXT BOOKS:

"Standard Handbook for Electrical Engineers."

Bell—"Electric Distribution for Electric Railways."

Gozenbock—"Engineering Preliminaries for an Interurban, Electric Railway."

207. ELECTRIC DESIGN PROBLEMS.

FOURTH YEAR, SECOND SEMESTER, LAST EIGHT WEEKS, SIX HOURS PER WEEK.

A course of laboratory and drafting to accompany No. 205

REFERENCE:

Parshall and Hobart—"Electric Machinery Design."

Norris and Dennison—"A Course of Problems."

208. ELECTRICAL MACHINERY.

MINING ENGINEERS, FIRST TERM, THREE HOURS PER WEEK.

This is a special course in Electrical Machinery for students not specializing in Electrical Engineering. It is designed to give the student a general knowledge of the design, construction and operation of electric dynamos, motors, transformers, and measuring instruments of various types and makes. In the accompanying laboratory course, the student is made familiar with the handling, operating and testing of electrical machinery.

TEXT AND REFERENCE BOOKS:

Sheldon and Mason—"Alternating Current Machinery."
Franklin and Esty—"Elements of Electrical Engineering."

209. ELECTRICAL MEASUREMENTS & PHOTOMETRY.

ELECTRICAL ENGINEERS, FOURTH YEAR, SECOND SEMESTER, THREE HOURS CREDIT, FIRST SEVEN WEEKS, FIVE HOURS LECTURE AND RECITATION AND TWO LABORATORY PERIODS.

This course deals with electric measuring instruments, their construction and sources of error. Precise measurements are made of current, electric-motive force, magnetism, induction and permeability. Practice is given in the calibration of measuring instruments. There is also a study made of illuminants in general and the performance of various types of arc, incandescent and vapor lamps and measurements made of their illuminating power.

TEXT AND REFERENCE BOOKS:

Carhart and Patterson—"Electrical Measurements."
Cravath and Lansingh—"Practical Illumination."
Stine—"Photometric Measurements."
Karapetoff—"Experimental Electrical Engineering."
Hulman—"Precision of Measurements."

210. ELECTRICAL ENGINEERING LABORATORY.

THIRD YEAR, FIRST AND SECOND SEMESTER, TWO THREE-HOUR PERIODS A WEEK, TWO HOURS CREDIT.

A series of experiments to accompany course No. 201. Its purpose is to illustrate the fundamental principles and to give the student practice in operating and testing electrical machinery. The first experiments are in the construction and use of electric measuring instruments followed by a study of methods and practice in testing motors, generators, convertors, motor generators, constant current machines and arc and incandescent lamps.

TEXT BOOKS:

Karapetoff—"Laboratory Manual."

REFERENCE.

C. F. Smith—"Testing of Dynamos and Motors."
Franklin and Esty—"Dynamo Laboratory Manual."
Sever—"Electric Engineering Experiments."
Sever and Townsend—"Factory and Laboratory Tests in Electrical Engineering."
Swensen and Frankenfield—"Testing of Electro-magnetic Machinery."

211. ELECTRICAL ENGINEERING LABORATORY.

FOURTH YEAR, FIRST AND SECOND SEMESTER, TWO THREE HOUR PERIODS PER WEEK, TWO HOURS CREDIT.

A continuation of course No. 210, dealing with testing of electrical machinery, precise electrical measurements, standardization and photometry.

TEXT AND REFERENCE:

See No. 210.

220. CONTRACTS AND SPECIFICATIONS.

FOURTH YEAR, MECHANICAL AND ELECTRICAL ENGINEERS. SECOND SEMESTER, ONE HOUR CREDIT.

This course is designed to give the student a general knowledge of preparing specifications and the law of contracts. Lectures on the subject by practicing solicitors will be arranged during the course.

REFERENCE:

Wait—"Law of Contracts.
Johnson—"Contracts and Specifications."

301. THERMODYNAMICS.

THIRD YEAR, FIRST SEMESTER, FIVE HOURS A WEEK, LECTURES AND RECITATIONS.

This course in heat is considered one of the fundamentals of engineering and great stress is laid on the thorough mastery of its laws.

The elementery laws of heat and its effect are studied; the general laws of thermodynamics; theoretical heat engines, isothermal and adiabatic expansion; the application of the laws to the steam and other engines; the principles governing the transfer of heat from gases to water.

TEXT:

Ewing's—"Steam Engine."

REFERENCE.

Geberhardt—"Steam Power Plant Engineering."
Benjamin—"Heat and Steam."
French—"The Steam Turbine."
Hutton—"Steam Engines."
Stadola—"Steam Turbine."
Peabody—"Thermodynamics of Steam Engineering.
Ripper—"Steam Engine."

302. STEAM MACHINERY.

THIRD YEAR, SECOND SEMESTER, LAST SIX WEEKS, FIVE HOURS A WEEK, LECTURES AND RECITATIONS.

This is a continuation of Course 301. It deals with fuel and its heat value, coal and ash handling machinery; furnaces, stokers and combustion, installation and operation. Running parallel with it is the laboratory course in Engine and Boiler testing.

TEXT:

Geberhart—"Steam Power Plant Engineering."

REFERENCE:

Same as No. 301.

303. STEAM POWER PLANTS.

FOURTH YEAR, MECHANICAL AND ELECTRICAL ENGINEERS. FIRST SEMESTER, SIX WEEKS, FIVE HOURS A WEEK AND SECOND SEMESTER, FIFTEEN WEEKS, FIVE HOURS A WEEK.

A general study of choice of types in power station equipment, fuels and combustion, boilers, furnaces and mechanical stokers, superheat, coal and ash handling, chimneys, mechanical draft, steam engineering, steam turbines, condensers, and accessories and gas engines and gas producers, etc.

TEXT:

Geberhart—"Steam Power Plant Engineering."

REFERENCE:

Fernald—"Prime Mover and Power Plants."
Hutton—"Mechanical Engineering of Power Plants."
Jones—"Gas Engine."
Carpenter and Diedrichs—"Gas Engine."

310. MECHANICAL ENGINEERING LABORATORY.

THIRD YEAR, FIRST AND SECOND SEMESTER, THREE HOURS A WEEK.

A course of testing indicators and gauges, steam and gas and gasoline engines; dynamometers and the measurement of power, pyrometers and the measurement of heat; calorimeters, for steam and gas; pumping machinery and hydraulic motors.

REFERENCE:

Carpenter's—"Experimental Engineering."

311. MECHANICAL ENGINEERING LABORATORY.

FOURTH YEAR, FIRST AND SECOND SEMESTER, THREE HOURS A WEEK.

A continuation of course No. 310, and deals with the more difficult problems of efficiency tests, power plant and commercial tests. Visits will be made to local plants and in some cases arrangements may be made to conduct tests under the direction of the college officials.

REFERENCE:

Carpenter's—"Experimental Engineering."
Flather's—"Dynamometers and the Measurment of Power."

321. KINEMATICS OF MACHINES.

THIRD YEAR, FIRST SEMESTER, THREE HOURS PER WEEK.

Treats of the application of the principles of Mechanics to machines; study of elementary machine parts; cams, gears, links and velocity diagrams; a systematic study of relative motions in machines and methods of producing the desired movements.

TEXT:

Durley's—"Kinematics of Machines."

REFERENCE:

Barr—"Kinematics of Machines."
Stahl and Wood—"Elementary Mechanism."
Goodman's—"Mechanics applied to Engineering."
Dalby's—"Balancing of Engines."
Spangler—"Valve Gears."
Dunkerly—"Mechanism."

322. KINEMATICS OF MACHINES.

FOURTH YEAR, FIRST SEMESTER, MECHANICAL ENGINEERS FIRST NINE WEEKS, FIVE HOURS A WEEK.

A continuation of course 321, dealing with inertia and kinetic energy of moving parts of machines, valve gears, engine governors and balancing of engines.

TEXT AND REFERENCE:

Same as No. 321.

330. MACHINE DESIGN AND DRAWING.

THIRD YEAR, FIRST AND SECOND SEMESTERS, TWO DRAWING PERIODS PER WEEK.

Lettering of mechanical drawings; preparations of working drawings of simple machines and the necessary drawing in connection with the kinematics course: tracing and blueprinting.

TEXT AND REFERENCE:

Spooner—"Machine Design."
Reid—"Machine Design."
Wilson—"Lettering."
Benjamin—"Machine Design."

331. MACHINE DESIGN AND DRAWING.

FOURTH YEAR, MECHANICAL AND ELECTRICAL ENGINEERS.

A course of two lectures and recitations, last six weeks first semester, and first seven second semester, continuing course 330. Design of cams and gear teeth, details of standard machinery, belt and pulley transmission, pipes and pipe joints and engine details.

101. MECHANICS OF ENGINEERING, I.

THIRD YEAR, FIRST SEMESTER, FIFTEEN WEEKS, FIVE HOURS PER WEEK.

Prerequisite, third year entrance requirements.

Recitations in statics, dynamics, and mechanics of materials; with graphic and analytic solutions of problems.

TEXT:

Maurer—"Technical Mechanics."

102. MECHANICS OF ENGINEERING, II.

THIRD YEAR, FIRST NINE WEEKS OF THE SECOND SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: 101.

A continuation of the study of the mechanics of materials begun in Course 101, also a study of engineering materials and the elastic limits, working stresses, and ultimate resistances of cast iron, wrought iron, steel, timber, stone, etc. Laboratory work accompanies this course. (See 103.)

TEXT:

Merriman—"Mechanics of Materials."

103. MATERIALS TESTING.

THIRD YEAR, SECOND SEMESTER, FIFTEEN WEEKS, ONE THREE-HOUR LABORATORY PERIOD PER WEEK. CONCURRENT WITH NO. 102.

Testing wrought iron, cast iron, steel and wood; in tension in compression, transversely, in sheer; torsion tests, bending tests, tests of riveting, concrete beams, etc.

105. GRAPHIC STATICS.

THIRD YEAR LAST SIX WEEKS OF THE SECOND SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: No, 101.

A study of the general principles of the force and equilibrium polygons; and the application of these principles in determination of stresses in framed structures; of sheer and bending moment in beams.

TEXT:

Malcolm—"Graphic Statics."
Ketchum—"Steel Mill Buildings."

111. THEORETICAL HYDRAULICS.

THIRD YEAR, FIRST NINE WEKES OF THE SECOND SEMESTER, FIVE HOURS PER WEEK.

Prerequisite: No. 101.

A consideration of the theory of the pressure and flow of water and its measurement. The design and construction and use of pumps, rams, propellers, turbines and other types of water wheels. This course is accompanied by laboratory work. (See 112.)

TEXT:

Unwin—"Hydraulics."

112. HYDRAULIC TESTING.

THIRD YEAR, SECOND SEMESTER, FIFTEEN WEEKS, ONE THREE-HOUR PERIOD PER WEEK.
CONCURRENT WITH 111.

Experiments for determining the discharge of water through pipes, orifices, weirs: also efficiency tests on the ram, turbine, pelton wheel, etc.

410. METALLURGY OF IRON AND STEEL.

FOURTH YEAR, SECOND SEMESTER, TWO HOURS A WEEK.
SHORT COURSE FOR CIVIL, ELECTRICAL AND MECHANICAL ENGINEERS.

This course deals principally with the physical and chemical properties of iron and steel rather than with the metallurgical chemistry or the special machinery used in the various processes of manufacture. A great deal of stress is laid upon the influence of hot and cold working, heat-treatment, the effects of the various elements on the physical properties of steel and the writing of specifications for rails, plates, structural steel, etc.

Materials used in steel making—Ore fuel and flux.

Manufacture of Pig Iron—Blast furnace construction and operation, chemical processes involved, chemical and physical properties of cast iron.

Manufacture of Steel—Different processes,acid and basic Bessemer, modes of operation, elimination of impurities, recarburization, differences between acid and basic processes in operation and product, construction and operation of open-hearth furnace, producers, coke ovens, heating furnaces, acid open-hearth practice, elimination of impurities, recarburization, comparisons of acid and basic Bessemer and open hearth processes.

Special Steels–manufacture of crucible steel,chemical history of crucible melting, high carbon steels in the open-hearth furnace, manufacture of steel castings, blowholes, special alloys in the electric furnace.

Wrought Iron—History, modes of production, elimination of impurities, comparison with soft steel.

Foundry Work—Different classes of molds, cupela furnaces, methods of casting, malleable castings.

Mechanical Treatment–Segregation and homogeneity,soaking pits, rolling of steel, percentage decrease in passes, effect of thickness upon the physical properties of rolled shapes, forging, hydraulic forge press.

Heat Treatment—Annealing, working temperatures, quenching, hardening, tempering, influence of hot and cold working, relation of work and temperature, effects of work on

structure of rails, structural shapes, etc., effects of heat treatment on various classes of steels

Effects of various elements in Steel.—Influence of carbon, silicon, manganese, sulphur, phosphorus, nickel, tungsten, vanadium, chromium, etc. on the physical properties of steel.

Structure of Steel—Steel a solution of various elements in iron, analogies in physical chemistry, critical points, microstructure of steels, theories regarding the structure of steel.

Specifications — Chemical and physical specifications for structural steel, rails, boiler plate, rods, etc., methods of testing.

TEXT BOOK:

Stoughton—"Metallurgy of Iron and Steel."

BOOKS FOR STUDY:

F. W. Harbord—"Metallurgy of Steel."

H. H. Campbell—"Manufacture and Properties of Steel.

111. DEPARTMENT OF MECHANICAL ENGINEERING.

This is a four year's course, the third and fourth of which are given in the Technical College, as outlined in the following schedule. It is designed to give the student a thorough knowledge of the basic principles of the design, construction, manufacture and operation of machinery as used in manufacturing industries, power plants and power transmission, as well as a general knowledge of executive management of the industries and plants.

Students who take the course should have a thorough training in mathematics, physics and shop work, and should have a natural aptitude in machinery, engines and tools.

All mechanical engineers require a good general knowledge of electricity, and all electrical engineers require training in mechanical principles. Therefore the two courses are similar throughout, and identical in the third year. In the fourth year the student is given less of electricity and electrical machinery and goes deeper into the study and design and performance of machinery, steam and gas engines and steam turbines. The mechanical laboratories are designed and equipped so as to give the student the necessary practice in the handling of machines and the testing and operation of engines. The equipment is thoroughly modern and adapted to illustrate the principles of the course as given in the class room.

In addition to the college laboratory practice, visits will be made to the local power plants and manufacturing industries.

301. THERMODYNAMICS.

THIRD YEAR, FIRST SEMESTER, FIVE HOURS A WEEK, LECTURES AND RECITATIONS.

This course in heat is considered one of the fundamentals of engineering and great stress is laid on the thorough mastery of its laws.

The elementary principles of heat and its effect are studied; the general laws of thermodynamics; theoretical heat engines,

isothermal and adiabatic expansion; the application of the laws to the steam and other engines; the principles governing the transfer of heat from gases to water.

TEXT:

Ewing's—"Steam Engine."

REFERENCE:

Geberhardt—"Steam Power Plant Engineering."
Benjamin—"Heat and Steam."
French—"The Steam Turbine."
Hutton—"Steam Engines."
Stadola—"Steam Turbine."
Peabody—"Thermodynamics of Steam Engineering."
Ripper—"Steam Engine."

302. STEAM MACHINERY.

THIRD YEAR, SECOND SEMESTER, THREE HOURS A WEEK. LECTURES AND RECITATIONS.

This is a continuation of Course No. 301. It deals with fuel and combustion, furnaces, boilers and steam production; the steam engine, the indicator and engine economy; condensors and auxiliary machinery. Running parallel with it is the laboratory course in Engine and Boiler testing.

TEXT:

Geberhardt—"Steam Power Plant Engineering."

REFERENCE:

Same as No. 301.

303. STEAM POWER PLANTS.

FOURTH YEAR, MECHANICAL AND ELECTRICAL ENGINEERS, FIRST SEMESTER, SIX WEEKS, FIVE HOURS A WEEK AND SECOND SEMESTER, FIFTEEN WEEKS, FIVE HOURS A WEEK.

A general study of choice of types in power station equipment; the economics of efficiency vs. cost; fixed and operating charges; local conditions relative to each case which govern in choice of machinery; the cost of power; the laying out of power plants under assumed working conditions; design, preparation of bill of material, estimating the first cost; the influence of the cost of raw material, fuel, water, labor, and load factor, on the design: preparation of contract and specification.

TEXT:

Geberhart—"Steam Power Plant Engineering."

REFERENCE:

Fernald—"Prime Movers and Power Plants."
Hutton—"Mechanical Engineering of Power Plants."
Jones—"Gas Engine."
Carpenter and Diedrichs—"Gas Engine."

304. STEAM TURBINES.

FOURTH YEAR, FIRST SEMESTER, MECHANICAL ENGINEERS, TWO HOURS CREDIT.

A study of the types of turbines and the theory of their performance, the flow of steam and its action on the curved surface of the buckets, efficiency of turbine and their utility in general as compared with other forms of steam engine.

TEXT AND REFERENCE:

Stadola—"The Steam Turbine."

305. GAS ENGINES.

FOURTH YEAR, FIRST SEMESTER, MECHANICAL ENGINEERS, FIRST NINE WEEKS, THREE HOURS CREDIT.

Gas engine types and points to be considered in making selection, small gas and gasoline engines, stationary and marine, larger producer gas engines, their design and operation, including methods of starting and igniting and sources of trouble, gas producers, their design, operation and efficiency.

TEXT AND REFERENCE:

Lucke—"Gas Engine Design."
Carpenter and Diedrichs—"Gas Engines."
Jones—"Gas Engine."
Robinson—"Gas and Oil Engines."

306. MECHANICAL ENGINEERING ABSTRACTS.

FOURTH YEAR, FIRST AND SECOND SEMESTER, MECHANICAL ENGINEERS, ONE HOUR.

This is a course dealing with current engineering problems. Topics will be assigned and reports required based on discussions in current engineering magazines, which will be on file in the library of the college.

307. STEAM BOILERS.

FOURTH YEAR, MECHANICAL ENGINEERS, SECOND SEMESTER LAST SIX WEEKS, TWO HOURS CREDIT.

The design and construction of steam boilers; horizontal return tubular boilers, the shell, tubes, and methods of riveting and staying; water tube boilers,—horizontal and vertical, a study of the relative merits of the various types.

TEXT AND REFERENCES:

Parsons—"The Steam Boiler."
Peabody and Miller—"The Steam Boiler."
Geberhardt—"Steam Power Plant Engineering."
Kent—"Steam Boiler Economy."

310. MECHANICAL ENGINEERING LABORATORY.

THIRD YEAR, FIRST AND SECOND SEMESTER, THREE HOURS A WEEK.

A course of testing indicators and gauges, steam and gas and gasoline engines; dynamometers and the measurement of power, pyrometers and the measurement of heat; calorimeters, for steam and gas; pumping machinery and hydraulic motors.

REFERENCE:

Carpenter's—"Experimental Engineering."

311. MECHANICAL ENGINEERING LABORATORY.

FOURTH YEAR, FIRST AND SECOND SEMESTER, THREE HOURS A WEEK.

A continuation of course No. 310, and deals with the more difficult problems of efficiency tests, power plant and commercial tests. Visits will be made to local plants and in some cases arrangements may be made to conduct tests under the direction of the college officials.

REFERENCE:

Carpenter's—"Experimental Engineering."
Flather's—"Dynamometers and Measurement of Power."

321. KINEMATICS OF MACHINES.

THIRD YEAR, FIRST SEMESTER, THREE HOURS PER WEEK.

Treats of the application of the principles of mechanics to machines; study of elementary machine parts; cam gears, links and velocity diagrams; a systematic study of relative motions in machines and methods of producing the desired movements.

TEXT:

Durley's—"Kinematics of Machines."

REFERENCE:

Barr—"Kinematics of Machines."
Stahl and Wood—"Elementary Mechanism."
Goodman's—"Mechanics applied to Engineering."
Dolby's—"Balancing of Engines."
Spangler's—"Valve Gears."
Dunkerly's—"Mechanism."

322. KINEMATICS OF MACHINES.

FOURTH YEAR, FIRST SEMESTER, MECHANICAL AND ELECTRICAL ENGINEERS, FIRST NINE WEEKS, FIVE HOURS A WEEK.

A continuation of course No. 321, dealing with inertia and kinetic energy of moving parts of machines, valve gears, engine governors and balancing of engines.

TEXT AND REFERENCE:

Same as No. 321.

330. MACHINE DESIGN AND DRAWING.

THIRD YEAR, FIRST AND SECOND SEMESTERS, TWO DRAWING PERIODS PER WEEK.

Lettering of mechanical drawings, preparations of working drawings of simple machines and the necessary drawing in connection with the kinematics course; tracing and blueprinting.

TEXT AND REFERENCE:

Spooner—"Machine Design."
Reid—"Machine Design."
Wilson—"Lettering."
Benjamin—"Machine Design."

331. MACHINE DESIGN AND DRAWING.

FOURTH YEAR, MECHANICAL AND ELECTRICAL ENGINEERS

A course of two lectures and recitations, last six weeks first semester, continuing course No. 330. Design of cams and gear teeth, details of standard machinery, belt and pulley transmission, pipes and pipe joints and engine details.

TEXT AND REFERENCE:

Benjamin—"Machine Design."
Spooner—"Machine Design."
Reid—"Machine Design."
Unwins—"Machine Design."
Anthony—"Essentials of Gearing."

332. MACHINE DESIGN AND DRAWING.

FOURTH YEAR, MECHANICAL ENGINEERS, SECOND SEMESTER, FIRST SEVEN WEEKS, LECTURES, RECITATIONS AND DRAWING, THREE HOURS CREDIT.

A continuation of No. 331, dealing with more difficult problems in the design of steam engines, gas engines and machine tools.

333. DESIGN PROBLEMS.

FOURTH YEAR, MECHANICAL ENGINEERS, SECOND SEMESTER, LAST EIGHT WEEKS, TWO HOURS CREDIT.

A course of problems as assigned in design along lines in which the student expects to specialize.

201. ELECTRICAL MACHINERY.

THIRD YEAR, FIRST AND SECOND SEMESTER, THREE HOURS A WEEK.

This is a course of three recitations per week. Topics considered are:—History of the development of Dynamo-Electric Machinery, definitions of dynamo, motor, magnetic field, magneto-motive force, hysteresis, etc. Materials used by the electrical engineer, parts of the dynamo and the general consideration of circuits, transformers, motor generators, constant and variable currents and the general effect on an electric circuit of a variable current; theory and characteristics of direct current generators and motors, including series, shunt and compound wound machines; the theory of commutation, speed control of motors, and a discussion of the principles of testing electric machinery.

TEXT BOOK:

Norris—"Elements of Electrical Engineering."

REFERENCE:

Sheldon—"Dynamo-Electric Machinery."

S. P. Thompson—"Dynamo-Electric Machinery."

J. A. Ewing—"Magnetic Induction of Iron and other Metals."

Reid—"Elementary Electrical Engineering."

Crocker—"Electric Lighting, Vol. I and II."

Franklin and Esty—"Elements of Electrical Engineering."

203. ELECTRICAL ENGINEERING ABSTRACTS.

THIRD AND FOURTH YEARS, FIRST AND SECOND SEMESTERS, ONE HOUR PER WEEK.

The students meet once a week for one hour to discuss current magazines, bulletins from manufacturers, proceedings of the Engineering Societies, late inventions and items of general interest to the Engineer.

Reports on various assigned topics will be required.

205. ELECTRIC DISTRIBUTION.

FOR MECHANICAL AND ELECTRICAL ENGINEERS, FOURTH YEAR, THREE HOURS CREDIT LAST NINE WEEKS FIRST SEMESTER, AND FIRST EIGHT WEEKS SECOND SEMESTER.

This course deals with the transmission of power by means of electrical energy; fundamental problems in transmission line design; conditions affecting choice of apparatus; line voltage, etc. A study will be made of certain leading transmission systems which are at present in operation with a view of ascertaining the reasons for selecting such apparatus and the effect on the result had another system been chosen.

REFERENCE:

Crocker—"Electric Lighting."

"Standard Handbook for Electrical Engineers."

Thompson—"Dynamo Electric Machinery."

Lyndon—"Development and Electrical Distribution of Water Power."

210. ELECTRICAL ENGINEERING LABORATORY.

THIRD YEAR, FIRST AND SECOND SEMESTER, TWO THREE HOUR PERIODS A WEEK, TWO HOURS CREDIT.

A series of experiments to accompany course No. 201. Its purpose is to illustrate the fundamental principles and to give the student practice in operating and testing electrical machinery. The first experiments are in the construction and use of electric measuring instruments followed by a study of methods and practice in testing motors, generators, convertors, motor generators, constant current machines and arc and incandescent lamps.

TEXT BOOKS:

Karapetoff—"Laboratory Manual."

REFERENCE:

C. F. Smith—"Testing of Dynamos and Motors."

Franklin and Esty—"Dynamo Laboratory Manual."

Sever's—"Electric Engineering Experiments."

Sever and Townsend—"Factory and Laboratory Tests in Electrical Machinery."

Swensen and Frankenfield—"Testing of Electro-magnetic Machinery.

211. ELECTRICAL ENGINEERING LABORATORY.

FOURTH YEAR, FIRST AND SECOND SEMESTER, TWO THREE HOUR PERIODS PER WEEK, TWO HOURS CREDIT.

A continuation of course No. 210, dealing with testing of electrical machinery, precise electrical measurements, standardization and photometry.

TEXT AND REFERENCE:

See No. 210.

220. CONTRACTS AND SPECIFICATIONS

FOURTH YEAR, MECHANICAL AND ELECTRICAL ENGINEERS, SECOND SEMESTER, ONE HOUR CREDIT.

This course is designed to give the student a general knowledge of preparing specifications and the law of contracts. Lectures on the subject by practicing solicitors will be arranged during the course.

REFERENCE.

Wait—"Law of Contracts."

Johnson—"Contracts and Specifications."

101. MECHANICS OF ENGINEERING, I.

THIRD YEAR, FIRST SEMESTER, FIFTEEN WEEKS, FIVE HOURS PER WEEK.

Pre-requisite: Third year entrance requirements.

Recitations in statics, dynamics and mechanics of materials; with graphic and analytic solutions of problems.

TEXT:

Maurer—"Technical Mechanics."

102. THEORETICAL MECHANICS, See p. 15
103. MATERIALS TESTING. See p. 37
105. GRAPHIC STATICS, See p. 38
111. THEORETICAL HYDRAULICS, See p. 16
112. HYDRAULIC TESTING, See p. 16
410 METALLURGY OF IRON AND STEEL, See p. 39

DEPARTMENT OF MINING ENGINEERING.

400. QUANITATIVE ANALYSIS.

THIRD YEAR, FIRST AND SECOND SEMESTERS, LECTURE ONE HOUR A WEEK, LABORATORY NINE HOURS A WEEK BOTH TERMS.

The aim of this course is to acquaint the student with the theory and practice of representative methods of gravimetric and volumetric quantitative analysis. A high standard of accuracy is required in most of the work so that the student may be qualified to make analysis of the refinement demanded in umpire work. Toward the end of the course, the student is familarized with some common commercial methods for analyzing ores, slags, and metallurgical products and is required to make a certain number of determinations within a time limit.

The lectures cover the chemical theory upon which the separations are based with stochiometrical problems and elementary treatment of the theory of solutions.

The following analysis are included in the course and are supplemented with extra work according to the rapidity with which each individual works:

Chlorine in salt, iron and sulphur in ferrous ammonium sulphate, calcium and magnesium in dolomite, lead, copper, and zinc in brass, silica in ore undecomposable by acid alone, alkalinity of soda ash, acid strength of oxalic acid, iron in ore by bichromate and permanganate methods, antimony in stibnite by iodine method, sulphur, phosphorus, manganese, carbon in steel, copper, lead, arsenic, calcium, zinc in ores, tin in babbitt metal, proximate analysis of coal.

TEXT BOOKS:

Talbot—"Quantitative Analysis."
Blair—"Chemical Analysis of Iron."
Low—"Technical Methods of Ore Analysis."
Millar—"Quantitative Analysis for Mining Engineers."

406. MINERALOGY.

FOUR HOURS PER WEEK.

This course includes descriptive and determinative mineralogy and crystallography.

The instruction in crystallography consists of a short series of lectures with laboratory practice with wooden models and natural crystals. The aim is to enable the student to identify the common crystallographic forms.

The time will be largely given to laboratory work in order to train the student to determine minerals accurately and rapidly by their physical and chemical properties, to make him thoroughly acquainted with the appearance, properties, uses and association of the more important mineral species.

The determinative mineralogy begins with a drill in the methods of blow-pipe analysis with a view to preparing the student for the practical determination of the more important ore making minerals.

This is followed by determinative mineralogy proper.

Text Books:

Moses and Parsons—"Crystallography, Mineralogy, and Blow-pipe Analysis."

Books of Reference.

Brush and Penfield's—"Manual of Determinative Mineralogy and Blow-pipe Analysis."

Dana's—"Textbook of Mineralogy."

Tillman's—"Important Minerals and Rocks."

407. ECONOMIC GEOLOGY.

THREE HOURS A WEEK DURING FIRST AND SECOND SEMESTER.

First Semester: Discussion of general features and formation of ore deposits; the cause of formation of cavities in rocks; their relation to ore bodies; discussion of the theories of ore

deposition; description of deposits of ores of iron, copper, lead, zinc, silver, gold, and lesser metals, with their occurrence, structure and geographic distribution.

Second Semester: The non-metallic minerals; the distribution and modes of occurrence of coal, petroleum, natural gas, asphalt, building stones, clay, lime and calcareous cements, gypsum, salines, fertilizers, abrasives, minor minerals, water supply, soil, and road materials; their properties, sources and uses will be studied as much in detail as possible in the time available.

Books.

Reis—"Economic Geology of the United States."

Kemp—"Ore Deposits of the United States and Canada."

Beck—"Nature of Ore Deposits."

"Reports of the Geological Surveys of the United States and Canada."

405. APPLIED GEOLOGY.

TWO HOURS A WEEK LECTURES, THIRD YEAR, WITH FIELD WORK ONE DAY DURING THE OPEN SEASON.

The lecture course deals with structural geology with respect to its effect on ore deposits. The principles of structural dynamical and chemical geology, practically applied to economic advantage in finding and exploiting ore bodies. Estimating the dip and strike of rocks, study of faults, folds, joints, etc., their relation to ore deposits and effects on previously formed ore bodies; careful study of the functions of fault movement: effects of glacial action; study of the various kinds of placer deposits; study of ore concentration by underground waters; secondary enrichment; metamorphism: process of ore deposition and concentration; arrangement of stratified rocks, their origin and characteristics: study of igneous rocks, classification and physical characters.

The field work is individual. The student will be required to make a careful study of the area assigned to him observing faults, folds, erosion and weather activity; glacial phenomena,

igneous and sedimentary rocks: cleavage, jointing, etc., making careful notes of all the dips and strikes. A full and accurate geological map with cross sections, will be required, also a short report on the work. The map will show the geological distribution and boundaries, the location of all important outcrops and structural features.

Books:

Spurr:—"Geology Applied to Mining."
Kemp:—"Handbook of Rocks."
Pirsson:—"Rocks and Rock Minerals."

415. MINE SURVEYING.

THIRD YEAR, FIRST SEMESTER, LECTURE ONE HOUR PER WEEK; FIELD WORK AND MAPPING, THREE HOURS A WEEK.

This course aims to acquaint the student with the special adaptation of surveying instruments and practices that are common in mine surveying.

Syllabus of course of Mine Surveying instruments and accessories, underground stations, carrying meridian underground, survey of secondary opening, survey record, use of mine maps, plotting mine maps, map filing bore hole surveys.

Text Books:

Trumbull:—Underground Surveying."

Books for Study:

Brough:—"Mine Surveying."
Lupton:—"Mine Surveying."

466. SUMMER COURSE IN PRACTICAL MINING.

THIRD YEAR, SUMMER VACATION, FOUR WEEKS OF OBSERVATION SKETCHING, ETC., AT TYPICAL PLANTS.

This course which lasts for six weeks in the summer between the third and fourth years consists in visits to typical mining and metallurgical plants in operation in Nova Scotia.

The first week is spent in geological surveying and mapping of some interesting district. The rest of the time is spent in observation, note taking, and sketching of various metal mining, ore concentration, coal mining, iron smelting or steel works, of which there are splendid examples in this province. Notes and sketches are written up in the evening. A full, neat report with sketches is required to be handed in by the students at the beginning of the Autumn Semester. Nearly all the students work in the mines in some practical capacity, either actual mining or surveying, and thus gain experience and aptitude that is invaluable in making their last year's course interesting and vital.

420. ASSAYING.

THIRD YEAR, SECOND SEMESTER, LABORATORY, SIX HOURS PER WEEK.

The purpose of this course is to acquaint the student with the theory and practice of fire assaying, as carried out today. The training prepares the student for the course in metallurgical laboratory where he is required to trace the ore values through the mill runs and metallurgical tests that make up the course. It also prepares him to quickly become an expert assayer after he leaves college, if he starts his engineering practice in such a position.

Lectures are given from time to time covering the following points: assay furnaces, tools, reagents, sampling, weighing, reduction and oxidation reactions, slag formation; the various methods of crucible fusion, scorification, cupellation, parting, and special methods for special ores and metallurgical products.

The following assays are required:—Reducing power, silver ores by scorification and crucible assay, gold ores by pot and muffle furnace fusion, lead ores by crucible fusion, ores with metallics, base and dore bullion, cyanide solutions, pig or blister copper, special ores and metallurgical products.

TEXT BOOK:

Lodge—"Notes on Assaying."

Books for Study:

Austin—"Fire Assay."
Fulton—"Manual of Fire Assaying."

425. PRINCIPLES OF METALLURGY.

THIRD YEAR, FIRST SEMESTER, LECTURES, THREE HOURS A WEEK.

This course deals with metals furnaces fuels and typical metallurgical processes, agents and products. It serves as an introduction to the course in the second semester of the junior year on metallurgy of non-ferrous metals and also to the course on the metallurgy of iron and steel. The subjects treated will be as given below:

Metals and alloys and their physical properties: structure, density, ductility, etc., analogies between fluid solutions and solid metals, diffusion of solid metals, liquation, solution of metals in metals, microstructure, annealing, hardening, tempering, hot and cold working of metals.

Solid Fuels:—Wood, peat, coals, charcoal, coke, beehive coke ovens, Appolt, Coppee, Jameson, Pernolet, Bauer, Simon-Carves, Otto Hoffman, Semet-Solvay, and Lurman coke ovens, briquettes.

Liquid and Gaseous Fuels—Petroleums and their use as a fuel, natural gas, producer gas, different forms of producers such as Siemens, Dawson, Wilson, Howson, Duff, Taylor types. Modern practice in making producer gas, calculation of composition of gas, thermal efficiency, water gas, recovery of by-products.

Furnaces:—Classification, kilns, blast furnaces for iron, lead and copper; reverberatory, crucible, muffle, retort, regenerative furnaces.

Theory of Recuperation:—Fundamental equations of heat utilization; study of gas furnaces with different methods of recuperation for gas and air; regenerative furnaces, heat balance sheets of gas furnaces, thermal efficiency, pyrometry, calorimetry, design of chimneys, regenerators, recuperators, valves and gas furnace details, electric furnaces and calorimetry.

Pyrometry:—Mercury and gas thermometers, Wiborg and Frew gas pyrometers; melting points; electric resistance and Le Chatelier pyrometers: optical pyrometers; calorimetry, Berthelot's Mahler bomb, Carpenter's, Junker's, Parr's Calorimeters.

Refractories: — Origin and classification of fire-clays analysis, effect of impurities, ganister, silicia, graphite, chromite, lime, dolomite, magnesite, bauxite, manufacture of bricks, furnace linings, crucibles, testing of fire clays.

Microstructure of Metals and Alloys: — Applications of theories of solutions to metals and metallic alloys, preparation of specimens, etching agents, microscopic examination and photography, interpretation of results, relation of structure to mechanical and heat treatment.

Books for Study:

Roberts-Austen—"Introduction to the Study of Metallurgy."

Sexton—"Fuel."

Damour-Queneau—"Industrial Furnaces."

Goerens—"Introduction to Metallography."

426. NON-FERROUS METALLURGY.

THIRD YEAR, SECOND SEMESTER, LECTURES, THREE HOURS A WEEK.

The main principles and modern practice of the metallurgy of the five principal metals are taken up in this course. The metals considered are copper, gold, lead, silver and zinc. The main stress is laid upon copper and gold.

Copper.

Practice of Roasting Copper Ores: Stall roasting, various forms of modern roasters, as O'Hara, Brown, McDougall, Pearce.

Blast Furnace Smelting: Classification of methods, metallurgical losses, removal of sulphur, calculation of charge,

smelting of oxidized ores, modern blast furnaces, handling of materials, flue-dust.

Reverberatory Smelting: Modern reverberatory furnaces, chemistry of the process, modern practice, details of equipment and operation.

Pyrite Smelting: Furnace phenomena, analogy with Bessemerizing, chemistry of the process, slag formation, fuel, influences of earthy bases on slags, modern practice, losses and costs.

Slags: Nomenclature, oxygen-ration, study of replacement value of bases, effects of various impurities, physical properties of slags.

Production of Metallic Copper from Matte: Principles of matte concentration, Welsh blister process, Bessemerizing of copper matte, Baggaley method.

Refining of Copper: Effect of impurities, comparative elimination of impurities, electrolytic reduction of copper, furnace refining of copper, refined copper.

Principles of furnace building.

Applications of thermochemistry.

Gold.

Physical and chemical properties of gold, gold compounds and alloys.

Stamp Milling of Gold Ores: Stamp battery and accessories, arrangement of plant, amalgamation, clean-up, retorting, melting, examples of stamp battery practice.

Chlorination Process: Plattner, vat and barrel processes, roasting, chemistry and history of processes, practice at modern mills. Thies process, bromination.

Cyanide Process: Evolution of process, testing of ores for adaptibility to cyanadation, percolation and leaching, dissolution of gold and silver, sources of loss of cyanide, precipitation of gold and silver, by zinc and electricity, clean-up, refining and smelting. Cyaniding plant and accessories for leaching, single and double treatment, crushing in cyanide solution. Slimes and slime treatment, agitation and natural

settlement, filter pressing, examples of modern practice. Design of cyanide plant and accessories, costs of construction and operation.

Gold Bullion: Refining, various methods of parting, assay of bullion.

Silver.

Physical and chemical properties of silver compounds.

Patio Process, crushing, treatment of ground ore, separation of amalgam, losses and cost.

The pan process, arrangement of plant, crushing, working of pan charge, types of pans, clean-up pan, handling omalgam, chemistry of process, losses and costs. Boss continuous process; roast-amalgamation process; drying, crushing, chloridizing, amalgamation, Reese River process, chemistry of process, losses and costs.

Chloridizing Roasting: Chloridization of sulphide and non-sulphide ores, hand and mechanical reverberatories, Stetefeldt furnace, losses and costs.

Hyposulphite Leaching Processes: Patera process; roasting, leaching, precipitation, chemistry of process, examples of modern practice; Russell process; chemical action of Russell solution, method of operation, examples of modern Russell plants, refining of recipitated sulphides.

Cyanide Leaching Process: Chemical reactions of silver ores in cyanide solutions, crushing, percolation, secondary chemical reactions, losses of cyanide, precipitation of silver by zinc and electric current, slime treatment, filter pressing, arrangement of plant, costs, examples of modern practice.

Lead.

Physical and chemical properties of lead, lead compounds and lead alloys.

Reverberatory Smelting: Ores, fuels and fluxes. Roasting of lead ores, Carinthian, English and Silesian methods.

Roast-Smelt in Pots: History of process, Huntington-Heberlein process, various modifications of process.

Smelting in the Open-Hearth: Mode of working, treatment of slags, recovery of flue dust.

Smelting in Blast Furnace: Lead slags, action of fluxes, fuels, roasting of ores, blast furnace and accessories, chemistry of the blast furnace, calculation of charge, method of operation, irregularities, furnace products, base bullion, speiss, mattes, slag, wall-accretions, hearth-accretions, flue-dust and treatment, losses and costs.

Desilverization of Base Bullion: Pattinson process, plant and mode of operation, Luce-Rozan process, Parke's process, plant, mode of operation, softening, liquating, refining, desliverization, skimming, treatment of zinc crusts, distillation, chemical treatment, treatment of by-products such as dross, etc.

Cupellation: German and English methods, furnaces, modes of operation, comparison of methods, losses and costs.

Books for Study.

Schnabel-Louis—"Handbook of Metallurgy."
Peters—"Principles of Copper Smelting."
Peters—"Modern Copper Smelting."
Rose—"Metallurgy of Gold."
Julian and Smart—"Cyaniding of Gold and Silver Ores."
Hofman—"Metallurgy of Lead."
Collins—"Metallurgy of Silver."
Ingalls—"Metallurgy and Properties of Zinc."

427. METALLURGY OF IRON AND STEEL.

FOURTH YEAR, FIRST SEMESTER, LECTURES FIVE HOURS PER WEEK.

In this course the metallurgy of iron and steel as carried out to-day is dealt with thoroughly. No obsolete practice is taken up unless deemed necessary for showing the development of a process. Much stress is laid upon metallurgical and thermal chemistry as applied to the iron and steel industry.

Pig Iron: Ores, fuels and fluxes, iron blast furnace and accessories, smelting practice, chemistry of process, calculating blast furnace charge, comparison of processes of purification of pig iron.

Wrought Iron and Crucible Steel: Different processes of making wrought iron, elimination of impurities. Process and plant for making crucible steel, chemistry of processes.

Acid and Basic Bessemer Steel: Plant and modern practice of acid and basic processes, chemistry and thermal efficiency of converters, comparison of two processes.

Acid and Basic Open-Hearth Steel: Open-hearth furnaces and accessories, acid and basic open-hearth practice. Special open-hearth processes, duplex process, chemistry and thermal efficiency of processes.

Mechanical Treatment of Steel: Forging, rolling, stamping, drawing, etc. Rolling Mill practice, heating furnaces.

Iron and Steel Foundry—Making of molds, design of patterns, cupola furnaces, steel casting practice, malleable castings.

Constitution of Iron and Steel: Solution theory as applied to metals and their alloys, freezing curves, Roozeboom diagram, micro-constituents of iron and steel, metallography of iron and steel, physical properties, effect of impurities on cast iron and steel.

Heat Treatment of Steel: Annealing, hardening and tempering of steel, improper heat treatment, constituents of hardened and tempered steels.

Special Alloy Steels.

Corrosion of Iron Steels.

Electro-metallurgy of Iron and Steel.

TEXT BOOK:

Stoughton—"Metallurgy of Iron and Steel."

BOOKS FOR STUDY:

Campbell—"Manufacture and Properties of Iron and Steel."

Harbord—"Metallurgy of Steel."

Sexton—"Outline of the Metallurgy of Steel."
Goerens—"Introduction to Metallography."
Osmond and Stead—"Microscopic Analysis of Metals."
Howe—"Iron, Steel and Other Alloys."

428. METALLURGY OF IRON AND STEEL.

FOURTH YEAR, FIRST SEMESTERS, LECTURES TWO HOURS A WEEK. SHORT COURSE FOR CIVIL, ELECTRICAL AND MECHANICAL ENGINEERS.

This course deals principally with the physical and chemical properties of iron and steel rather than with the metallurgical chemistry and the special machinery used in the various processes of manufacture. A great deal of stress is laid upon the influences of hot working, heat treatment, the effects of the various elements on the physical properties of steel and the writing of specifications for rails, plates, structural steel, etc.

Materials used in Steel Making—Ore, fuel, flux.

Manufacture of Pig Iron: Blast furnace, construction and operation, chemical processes involved, chemical and physical properties of cast iron.

Manufacture of Steel: Different processes, acid and basic bessemer, modes of operation, elimination of impurities, recarburization, difference between acid and basic processes in operation and product, construction and operation of open hearth furnace, producers, coke ovens, heating furnaces, acid open hearth practice, elimination of impurities, recarburization, comparisons of acid and basic processes.

Special Steels: Manufacture of crucible steel, chemical history of crucible melting, high carbon steels in the open hearth furnace, manufacture of steel castings, blowholes, special alloys in the electric furnace.

Wrought Iron: History, mode of production, elimination of impurities, comparison with soft steel.

Foundry Work: Different classes of molds, cupola furnaces methods of casting, malleable castings.

Mechanical Treatment: Segregation and homogeneity soaking pits, rolling of steel, reheating furnaces, influence of hot

working on steel, percentage decrease in passes, effect of thickness upon the physical properties of rolled shapes, forging, hydraulic press.

Heat Treatment: Annealing, working temperature, quenching, hardening, tempering, influence of hot and cold working, relation of work and temperature, effects of work on structure of rails, structural shapes, etc., effects of heat treatment on various classes of steel.

Effects of Various Elements in Steel: Influence of carbon, silicon, manganese, sulphur, phosphorus, nickel, tungsten, vanadium, chromium, etc. on the physical properties of steel.

Structural Steel: Steel a solution of various elements in iron, analogies in physical chemistry, critical points, microstructure of steels, theories regarding the structure of steel.

Specifications: Chemical and physical specifications for structural steel, rails, boiler plate, rods, etc., methods of testing.

TEXT-BOOK.

Stoughton—"Metallurgy of Iron and Steel."

BOOKS FOR STUDY.

Harbord—"Metallurgy of Steel."

Campbell—"Manufacture and Properties of Steel."

403. METALLURGICAL LABORATORY.

FOURTH YEAR, FIRST AND SECOND SEMESTER, LABORATORY EIGHT HOURS A WEEK.

This consists of metallurgical and mill tests and reports. Some of the tests are merely illustrative of processes and some are made with half-size regular furnaces and mill apparatus. Full reports are required in every case. A large amount of assaying is necessary in determining the distribution of values and losses in the products made in the different tests and this makes the student more proficient as an assayer.

Most of the following tests are carried out by the students in the fourth year.

High temperature measurement. Determination of the calorific power of fuels. Temperature limits of hardening power of steel. Oxidizing roast of a sulphide ore. Melting points of silicates. Corrosion of refractories by silicates, Copper selecting process. Chloridizing roast, barrel chlorination process. Cyanide process-leaching and slime treatment. Gold amalgamation test. Silver pan amalgamation. Lead or copper smelting in the blast furnace. Cupellation of base bullion. Refining of copper. Gold stamp mill run. Concentration by jigging with previous sizing and with classification. Wilfley table concentration. Vanner concentration.

450. EXPLORATION AND EXCAVATION.

THIRD YEAR, SECOND SEMESTER, LECTURES, THREE HOURS A WEEK.

This course serves as an introduction to engineering as applied to mining. The first part of the time is spent on elementary mechanism, and mechanical movements, because a knowledge of this subject is essential to an engineer who must deal with machinery and power problems as much as a mining engineer frequently is compelled to do. Problems are introduced into the work wherever possible. A syllabus of the material treated is nearly as follows :—

Mechanism: Mechanical powers, shafts, couplings, bearings, clutches, transmission of power by belts, ropes, friction gears, chains and cams.

Prospecting: Value of geology in prospecting, surface indications, trenching, trial pits, special indications of copper, iron, gold, zinc, coal, etc. prospecting for gold by glacial indications in Nova Scotia.

Boring: Well-augur, American oil well borer, Keystone driller, Mather and Platt's system, boring by percussion with rods, diamond drilling, calyx drill.

Compressed Air Machinery: Wet compressors, special machines for high pressure, valve details of various makes, indicator air-cards, duty and efficiency, receivers, pipe lines, various types of air drills as Darlington, Ingersoll, Rand, Sullivan, McKeirnan, Leyner, etc. Electric drills, coal undercut-

ting machines of puncher, disc, and chain types, tunneling machines, compressed air locomotives, compressed air auxiliary engines for hoisting, etc.

Explosives: Gunpowder, composition high explosives, such as gun cotton, nitroglycerin, dynamites, blasting gelatin, etc., Sprengel explosives, fulminates, "permitted" explosives, cartridges, detonators, fuses, care of explosives, theory of blasting, methods of drilling for excavations, electric machines for firing.

Shaft and Slope Sinking: Methods of drilling, firing and sinking, different methods of supporting circular and rectangular shafts, shaft timbering details, special methods of sinking in running ground, forepoling, sinking shoe with brick or concrete lining, tubbing, Poetsch freezing process, Kind-Chaudron process, caissons.

Supporting Excavations: Timber preservation, various methods of supporting levels with timber, special timbering for soft ground, Nevada square-set methods, masonry and steel supports.

Hydraulic Mining and Dredging: Prospecting placer ground, general consideration of dams, flumes, and ditches, special apparatus and practice in hydraulic mining, dredging machines, modern dredging practice, metallurgy and costs of dredging.

BOOKS FOR REFERENCE:

Richards—"Mining Notes."
Foster—"Textbook of Ore and Stone Mining."
"Coal and Metal Mining Pocketbook."
Peele—"Compressed Air Plant for Mines."
Guttmann—"Blasting."
DeKalb—"Manual of Explosives."
Storms—"Timbering and Mining."
Bowie—"Practical Treatise on Hydraulic Mining in California."
Weatherbe—"Dredging for Gold in California."

451. EXPLOITATION, HAULAGE AND PUMPING.

FOURTH YEAR, SECOND SEMESTER, LECTURES, THREE HOURS A WEEK.

Exploitation: Opening up of deposits, choice of plan of working, shaft versus slope, adits, overhand and underhand stoping. Methods of working ore bodies, working out beds with permanent and with temporary pillars, pillar robbing, caving system, slicing methods, milling method, system of filling, longwall and bord and pillar as applied to ore and coal; special methods applied to masses and thick ore bodies.

Haulage: Cars, tracks, animal haulage, steam air and electric locomotive haulage, comparative costs. Wire rope haulage systems; details, adaptibility, comparative costs of endless rope and main tail rope, aerial tramways. Hoisting; winch, windlass, whim. Power machinery for hoisting; steam engines for hoisting, first, second and third motion geared engines, use of water wheels, gasolene engines and electric motors for hoisting. Cylindrical and conical drums, reels, various forms of hand, steam and automatic brakes, methods and calculations for compensation, calculations for size of hoisting engine, Koepe and Whiting systems. Ropes; rope cappings, buckets, skips, cages; pulleys, detaching hooks, safety clutches, keps, surface and underground arrangement of hoisting plant.

Pumping: Origin of underground water, drainage through adits. Cornish pumping engine and pumping details, general arrangement in shaft efficieney, steam and compressed air pumps; piston and plunger, inside and outside packed, duplex pumps, differential plunger pumps, compound and triple expansion pumps, power driven pumps, centrifugal pumps, Frenier pump, air lift, rotary pumps, different pump valve gears as Cameron, Blake, Knowles, Worthington, Costs. Dams, Installation of Pumping Plants.

Books for Study.

Foster—"Text-book of Ore and Stone Mining."

Richards—"Mining Notes."

Ihlseng—"Manual of Mining."

International Text-book Co.—"Coal Mining."
Boulton—"Practical Coal Mining."
Mayer—"Mining Methods in Europe."
Hoover—"Principles of Mining."

452. VENTILATING, LIGHTING, ACCOUNTING AND VALUATION.

FOURTH YEAR, SECOND SEMESTER, LECTURES, THREE HOURS A WEEK.

Ventilation: Gases in mines, testing for various gases, explosive mixtures, natural ventilation, ventilation by furnace, water blast and steam jets, fan ventilation; various types of fans as Guibal, Schiele Capell, Nasmyth, Murphy, Waddle and Rateau. Manometric efficiency. Production of air currents, regulators, laws of friction, splitting of air currents, calculations relative to splitting, equivalent orifice, orifice of a passage, summation of orifices in series, graphic method of orifices, mine explosions, mode of procedure to recover miners and mine, rescue breathing apparatus, mine fires, cause and methods of suppression or exclusion.

Lighting: Candles, torches, acetylene lamps. Construction and use of safety lamps as Davy, Clanny, Evan-Thomas, Mueseler, Marsat, Ashworth-Heppelwhite-Gray, Wolf, Electric lighting underground.

Accounting: Cashbook, journal and ledger and how to keep them. Distribution of expense and segregation of costs. Prime cost maintenance, mine development and depreciation, renewal fund, sinking funds.

Valuation: Sampling a mine, contamination of samples, calculation of results, estimation of probable value, examples.

BOOKS FOR STUDY:

Foster—"Textbook of Ore and Stone Mining."
Richards—"Mining Notes."
Ihlseng—"Manual of Mining."
International Text-book Co.,—"Coal Mining."

Boulton—"Practical Coal Mining."
Wallace—"Simple Mine Accounting."
Rickard—"Sampling and Estimation of Ore in Mine."
Hoover—"Principles of Mining."

453. ORE DRESSING.

FOURTH YEAR, FRIST SEMESTER, LECTURES, THREE HOURS PER WEEK.

It is the purpose of this course to acquaint the student with the general theory and principles that underlie the modern practice of ore dressing. The theories and principles are illustrated by machines and mills that represent the most advanced methods of the preparation of ores and the extraction of their values. The different types of machines are criticized and also the combinations of machines that represent different milling practices.

Breaking: Crushing, comminuting.

Preliminary: Crushing, breakers, rolls, steam and gravity stamps, pulverizers, laws of crushing.

Separating: Concentrating, washing.

Preliminary washers: Sizing, screens and principles of screen sizing, classifiers, laws of classifying by fire settling in water, hand picking, jigs, laws of jigging, fine sand and slime concentrators, amalgamation, magnetic concentration, pneumatic concentrators, miscellaneous processes of separation.

Accessory Apparatus: Bins, receiving floors, samplers, feeders, distributors, conveyors, elevators, and wheels, pumps launders, unwaterers, miscellaneous apparatus.

Mill Processes and Management: Summary of Principles of separation, study of different classes of milling practice from typical mills.

General Ideas on Milling: Mill location, construction of buildings, power, power transmission, ventilation, lighting, labor, water, disposal of products, percentage extraction, limit of concentration, accounts and reports, losses and costs, testing an ore for a process.

TEXT BOOK:

Richards:—"Ore Dressing."

454. COAL MINING.

FOURTH YEAR, SECOND TERM, LECTURES, FIVE HOURS A WEEK FOR SIX WEEKS.

The course in coal mining lays stress on the special applications of engineering to the extraction of and preparation of coal.

Methods of working, haulage, ventilation, lighting and coal-washing are treated in a thorough manner with illustrative problems wherever possible.

Methods of Working: Bord and pillar systems and various modifications, longwall, working steep seams, working thick seams, working contiguous seams, shaft pillars, subsidence, submarine mining, spontaneous combustion.

Haulage: Rails, turntables and other haulage plant accessories. Details of mine tubs. Horses, stables, and costs. Self-acting inclines, back-balances and details of apparatus. Direct acting haulage. Main and tail-rope haulage. Endless rope haulage, haulage engines.

Winding: Head frame and accessories, skips, tanks, and cages, ropes, guides, etc. Hoisting engines, calculation for size of engines,counterbalancing. Special systems for winding from great depths.

Pumping: Special pumping machinery and accessories for pumping in coal mines.

Ventilation: Gases met with in mines, coal-dust, laws of friction, theory of air currents, mechanical ventilators, details of different types, fan engines, motors and methods of connection, secondary ventilation, useful effect, efficiency. Stoppings, doors, brattice, regulators, air-crossing, losses in circulation, theory of splitting, problems.

Lighting: Naked lights, electric lighting. History of development of safety lamps. Modern lamp such as Ashworth-Heppelwhite, Muesseler, Marsaut, Wolf, Morgan, etc. Under-

ground lighting stations. Delicate indicators as Pieler, Chesneau, Stokes, Ashworth, Shaw.

Surface Plant: Power house and distribution, plant arrangement, tipplers, screens, conveyors, bins, chutes, coal washing plant and accessories, Robinson, Coppee and Baum machines, coal washing jigs and tables.

TEXT BOOKS.

Hughes—"Text-book on Coal Mining."
Boulton—"Practical Coal Mining."
International Text-book Co.—"Coal Mining."
Kerr—"Practical Coal Mining."
Pamely—"Colliery Managers' Handbook."
"Coal and Metal Miners' Pocketbook."

460. MILL CONSTRUCTION.

FOURTH YEAR, FIRST SEMESTER, LECTURES, FIVE HOURS A WEEK FOR SIX WEEKS.

This course treats of the construction and equipment of mill and smelter buildings. It will include information on such structures as are required for sampling plants, ore concentration, steel mills, stamp mills, copper and lead smelters, etc.

Attention will be given to such practical details as are outlined.

Erecting building and machinery foundations, wooden and steel mill construction, saw-toothed roof construction, head frames, trusses and trestles, coal tipples, roof coverings, laying out shafting, pulleys, belts, and belting, erection of machines, pipe-fitting, setting of boilers, setting of turbines, lighting of mill buildings, protection of iron and steel from corrosion, cost of foundations, retaining walls, erection of buildings, installation of machinery, maintenance, depreciation.

BOOKS FOR REFERENCE:

Kidder:—"Architects' and Builders' Pocket-Book."
Hobart:—"Mill-wrighting."
Ingalls:—"Notes on Metallurgical Mill Construction."

461. MINE PLANT DESIGN.

FOURTH YEAR, FIRST AND SECOND SEMESTERS, DRAFTING, SIX HOURS A WEEK.

In this course the student is required to design some actual small plant or some portion of a large plant as would be necessary in the development of a mining or metallurgical enterprise. Working drawings of some such plant as a stamp mill, steel or wooden head frame concentration plant, smelter building etc., are prepared. The drawings must be supplemented also by bills of material, specifications and estimates.

465. THESIS.

FOURTH YEAR, SECOND SEMESTER, LABORATORY, NINE HOURS A WEEK.

This consists in an elementary, original investigation into some mining or metallurgical problems. This will acquaint the student with the methods of scientific investigation so that he will know how to tackle problems that arise in engineering work. The student must choose his subject before the end of the first semester of the fourth year. He must prepare a card catalogue and abstracts of the literature bearing on his problem and prepare a thorough complete report on the work in acceptable form.

500. MILITARY SCIENCE AND DRILL.

THIRD YEAR, FIRST AND SECOND SEMESTERS, TWO HOURS A WEEK.

SYLLABUS:

October and November:

Military Engineering comprising bridging, rafting, earth work, etc,

TEXT-BOOKS :

"Manual Military Engineering, 1905;" "Field Service Pocket book, 1907."

December and January :

Canadian Military Organization Tactics as outlined in Manual of Combined Training.

February :

Military History.

TEXT-BOOKS :

C. P. Lucas—"Canadian War, 1812."

Sir Jas. Carmichael Smyth—"Precis of Wars in Canada."

March, April and May :

Military Engineering, Defence of Posts, villages, obstacles, etc.

TEXT-BOOKS :

"Manual of Military Engineering. 1905."

"Map Reading and Reconnaissance."

"Manual of Map Reading and Field Sketching, 1906."

Military and Physical drill two half-hour exercises a week, throughout the year.

490. CONTRACTS AND SPECIFICATIONS.

FOURTH YEAR, SECOND SEMESTER, LECTURES FIVE HOURS A WEEK FOR THREE WEEKS.

General law of real estate, personal and employers liability, law of engineering contracts, provincial and Dominion Mining law, as compared with that in the United States and Mexico Nova Scotia Coal Mines Regulation Act.

*Three weeks field practice in camp the preceding summer.

THIRD YEAR. FIRST SEMESTER.

	SUBJECTS	Credits.	Weeks	HOURS PER WEEK. Expected Preparation.	Lectures and Class Work	Field Lab. or Drafting	FOR DETAILS SEE Page	Reference No.	PRE-REQUISITES
1	Mechanics of Engineering I	5	15	10	5		14	101	Third year entrance requirements
2	Railway Location	2	First 6	10	5		17	121	Third year entrance requirements
3	Ry. Construction and Maintenance.	3	Last 9	10	5		17	122	121
4	Thermodynamics	5	15	10	5		25	301	Third year entrance requirements
5	Mechanical Engineering Laboratory	2	15	1		3	26	310	Concurrent with 301
6	Electrical Machinery	3	15	6	3		24	201	Third year entrance requirements
7	Electrical Engineering Laboratory	2	15	1		3	25	210	Concurrent with 201
8	Drafting and Advanced Surveying	4	15	1		9	16	120	Third year entrance requirements
9	Military Science and Drill	1	15	1	1	1	72	500	

THIRD YEAR. SECOND SEMESTER.

	SUBJECTS	Credits.	Weeks	HOURS PER WEEK Expected Preparation	Lecture and Class Work	Field, Lab. or Drafting	FOR DETAILS SEE Page	Ref. No.	PRE-REQUISITES
1	Mechanics of Engineering II	3	First 9	10	5		15	102	101
2	Graphic Statics	2	Last 6	10	5		15	105	101
3	Materials Testing	2	15	1		3	15	103	Concurrent with 102
4	Theoretical Hydraulics	3	First 9	10	5		16	111	101
5	Roads and Pavements	2	Last 6	10	5		18	131	Third year entrance requirements
6	Hydraulics Testing	2	15	1		3	16	112	Concurrent with 111
7	Electrical Machinery	3	15	6	3		24	201	Third year entrance requirements
8	Electrical Engineering Laboratory	2	15	1		3	25	210	Concurrent with 201
9	Military Science and Drill	1	15	1	1	1	72	500	

Three weeks field practice in Camp the preceding summer.

FOURTH YEAR. FIRST SEMESTER.

	SUBJECTS	Credits.	Weeks	Hours Per Week: Expected Preparation	Hours Per Week: Lecture and Class Work	Hours Per Week: Field, Lab. or Drafting	For Details See: Page	For Details See: Ref. No.	Pre-Requisites
1	Masonry Construction—Arches, Dams, Foundations and Reinforced Concrete	5	15	10	5		19	141	102, 105, 111, 120
2	Materials Testing	2	15	1		3	19	142	Concurrent with 141
3	Water Supply	3	Last 9	10	5		20	151	102, 111, 301
4	Water Supply Design	1	Last 7½			6	20	152	Concurrent with 151
5	Railway Structures	2	First 7½	2		6	18	124	121, 123, 122
6	Ry. Field Work (Summer Work)*		3			48	17	123	121, 122
7	Roofs and Bridges	2	First 6	10	5		22	171	102, 105
8	Roofs and Bridges	2	15			6	23	172	Concurrent with 171
9	Geology	3	15	4	2	3	54	403	
10									
11									

FOURTH YEAR. SECOND SEMESTER.

	SUBJECTS	Credits.	Weeks	Hours Per Week: Expected Preparation	Hours Per Week: Lecture and Class Work	Hours Per Week: Field, Lab. or Drafting	For Details See: Page	For Details See: Ref. No.	Pre-Requisites
1	Hydraulic Engineering	3	First 4	10	5		21	153	111
2	Masonry and Reinforced Concrete Design	2	First 9			24	20	143	141
3	Sewerage	3	First 9	10	5		21	161	102, 111, 151
4	Seweage Disposal and General Sanitation	2	Last 6	10	5		22	162	161
5	Sewer Design	1	Last 2			24	22	163	161
6	Bridge Design	5	5th to 13th incl.			25	23	173	171, 172
7	Tunneling	1	10th to 12th incl.	10	5		18	125	301, 102, 111, 141
8	Metallurgy	2					57	4—	
9	Contracts and Specifications	1	Last 3	10	5		24	191	Preceding work of fourth year
10									

		Credits.	Weeks	Hours Per Week			For Details See		Pre-Requisites
				Preparation.	Lecture and Class Work	Field, and Lab. Drafting	Page	Ref. No.	
1	Electrical Machinery	3	15	16	3		27	201	Third year entrance req.
2	Electrical Laboratory	2	15	2	1	3	31	210	Concurrent with 201.
3	Steam Machinery	5	15	10	5		33	301	Third year entrance req.
4	Electrical Engineering Abstract	1	15	2	1		29	203	Third year entrance req.
5	Mechanical Engineering Laboratory	2	15	1		3	31	310	Concurrent with 301.
6	Mechanics of Engineering, I	5	15	10	5		37	101	Third year entrance req.
7	Military Science and Drill	1	15	1	1	1	72		
8	Machine Drawing and Design	2	15			6	36	330	Third year entrance req.
9	Kinematics of Machinery	3	15	6	3		35	321	Third year entrance req.

Second Semester.

		Cr.	Weeks	Hours Per Week			For Details See		Pre-Requisites
				Preparation	Lecture and Class Work	Field, Lab. and Drafting	Page	Ref. No.	
1	Electrical Machinery	3	15	6	3		27	201	Third year entrance req.
2	Electrical Laboratory	2	15	2		3	31	210	Concurrent with 201.
3	Thermodynamics	2	Last 6	10	5		33	302	301
4	Electrical Engineering Abstracts	1	15	2	1		29	203	Third year entrance req.
5	Mechanical Engineering Laboratory	2	15	2		3	31	310	Concurrent with 302.
6	Mechanics of Engineering, II	3	1st. 9	10	5		37	102	101.
7	Materials Testing	2	15	1		3	37	103	Concurrent with 102.
8	Theoretical Hydraulics	3	1st. 9	10	5		38	111	101.
9	Hydraulic Testing	2	15	1		3	38	112	Concurrent with 111.
10	Graphic Statics	2	Last 6	10	5		38	105	101.
11	Military Science and Drill	1	15	1	1	1	72		
12	Machine Design and Drawing	2	15			6	36	330	
13									

		Credits	Weeks	Hours Per Week			For Details See		Pre-Requisites
				Preparation	Lecture and Class Work	Field and Lab.	Page	Ref. No.	
1	Alternating Currents and Machinery	5	15	10	5	?	28	202	201
2	Electrical Engineering Laboratory	2	15	2	.....	3	31	211	210
3	Mechanical Engineering Laboratory	2	15	2	.....	3	35	311	310
4	Electrical Abstracts	1	15	2	1	.....	29	203	.....
5	Kinematics of Machinery	3	First 9	10	5	.....	36	322	321
6	Machine Design	2	Last 6	10	5	.....	36	331	330
7	Steam Power Plants	2	First 6	10	5	.....	34	303	301–302
8	Electrical Distribution	3	Last 9	10	5	.....	29	205	201
9	Machine Design Drawing	2	15	.....	.....	6	36	331	330
....	.....	....	....	.....	.....	.....	.....	.....	.....
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SECOND SEMESTER.

		Credits	Weeks	Hours Per Week			For Details See		Pre-Requisites
				Preparation	Lecture and Class Work	Field and Lab.	Page	Ref. No.	
1	Alternating Currents and Machinery	5	15	8	4	3	28	202	201
2	Electrical Engineering Laboratory	2	15	2	.....	3	31	211	210
3	Electrical Engineering Abstracts	1	15	2	1	.....	29	203	.....
4	Electric Measurements & Photometry	3	First 7	10	5	6	31	209	207
5	Electrical Distribution	3	First 8	10	5	.....	29	205	201
6	Electric Railways	2	Last 6	10	5	.....	30	206	203
7	Electric Design Problems	2	Last 8	.....	.....	6	30	207	205
8	Hydraulics	3	First 9	10	5	.....	21	153	111
9	Metallurgy	2	15	4	2	.....	39	410	.....
10	Contracts and Specifications	1	15	2	1	.....	32	220	.....
....	.....	..	.....	.....	.....	.....	.....	.....	.....
....	.....	...	.....	.....	.....	.....	.....	.....	.....
....	.....	....	.....	.....	.....	.....	.....	.....	.....

		Credits	Weeks	Hours Per Week			For Reference See		Pre-Requisites
				Preparation	Class and Lectures	Field Lab. Drafting	Page	Ref. No.	
1	Steam Power Plants	2	First 6	10	5		43	303	301–302
2	Steam Turbines	2	Last 6	10	5		43	304	
3	Gas Engines	3	First 9	10	5		44	305	
4	Electrical Distribution	3	Last 9	10	5		49	205	201
5	Machine Design	2	Last 6	10	5		47	331	330
6	Machine Design Drawing	2	15			6	47	331	330
7	Kinematics of Machinery	3	First 9	10	5		46	322	321
8	Mechanical Engineering Abstracts	1	15	2	1		44	306	
9	Mechanical Engineering Laboratory	3	15	2		6	45	311	310
10	Electrial Engineering Laboratory	2	15	2		3	49	211	210

Second Semester.

		Credits	Weeks	Hours Per Week			For Reference See		Pre-Requisites
				Preparation	Class and Lectures	Field Lab. Drafting	Page	Ref. No.	
1	Steam and Gas Power Plants	5	15	8	4		43	303	301–302
2	Metallurgy	2	15	4	2		51	410	
3	Steam Boilers	2	Last 6			6	44	307	
4	Electrical Distribution	3	Last 8	10	5		49	205	
5	Machine Design and Drawing	3	First 7	10	5	6	47	332	
6	Hydraulics	3	First 9	10	5		21	153	111
7	Mechanical Laboratory	2				3	45	311	310
8	Mechanical Engineering Abstracts	1					44	306	
9	Electrical Laboratory	2				3	50	211	
10	Design Problems	2	Last 8			6	47	333	
11	Contracts and Specifications	1	15				50	220	

THIRD YEAR. MINING ENGINEERING. FIRST SEMESTER

Engineering Camp.

SUBJECTS.	Credits	Length Weeks.	Hours per Week			Reference		Pre-Requisites.
			Preparation.	Class Work	Field Lab. or Drafting	Page	Ref. No.	
Mechanics of Engineering 1	5	15	10	5		14	101	Third year entrance requirements
Thermodynamics	5	15	10	5		33		Third year entrance requirements
Applied Geology	3	15	4	2	3	54	405	Third year entrance rebuirements
Quantitative Analysis	4	15	2	1		52	400	Third year entrance requirements
Principals of Metallurgy	3	15	6	3		57	425	Third year entrance requirements
Mine Surveying	2	15	2	1	3	55	415	Third year entrance requirements
Military Science and Drill	1	15	1	1	1	72	500	Third year entrance requirements

THIRD YEAR. SECOND SEMESTER

SUBJECTS	Credits	Length Weeks.	Hours per Week			Reference		Pre-Requisites.
			Preparation.	Class Work	Field Lab. or Drafting	Page	Ref. No.	
Mechanics of Engineering	3	First 9	10	5		15	102	101
Graphic Statics	2	Last 6	10	5		15	105	101
Steam Machinery	4	15	6	3	3	65		
Assaying	2	15			6	52	420	Third year entrance requirements
Exploration and Excavation	3		10	5		58	450	Third year entrance requirements
Quantitative Analysis	3	15			9	53	405	Third year entrance requirements
Non-Ferrous Metallurgy	3	15	6	3		72	426	A 25
Mineralogy	3	15	4	2	3	53	406	Third year entrance requirements
Military Science and Drill	1	15	1	1	1	72	500	

Summer Course in Practical Mining
Four to Six Weeks

MINING ENGINEERING.

FOURTH YEAR. FIRST SEMESTER

SUBJECTS	Credits	Length Weeks	Hours Per Week			Reference		Pre-Requisites
			Preparation	Class Work	Field, Lab. or Drafting	Page	Ref. No.	
Dynamo Electric Machines	4	15	6	3	3	67		
Exploitation Haulage and Pumping	3	15	6	3		19	451	450
Testing of Materials	2	15	1		3	71	142	
Mill Construction	2	First 6	10	5		61	460	101
Metallurgy of Iron and Steel	3	Last 3	10	5		64	427	425, 426
Metallurgical Laboratory	3	15	1		8	72	430	400, 420
Mine Plant Design	2	15			6	53	461	101, 102, 105
Economic Geology	3	15	6	3		69	407	405, 406
Ore Dressing	3	15	6	3		69	453	406

SUBJECTS	Credits	Length Weeks	Hours Per Week			Reference		Pre-Requisites
			Preparation	Class Work	Field, Lab. or Drafting	Page	Ref. No.	
Theoretical Hydraulics	3	First 3	10	5		16	111	101
Coal Mining	2	Last 6	10	5		70	454	451
Hydraulics Testing	2	15	1		3	16	112	Concurrent with 111
Metallurgical Laboratory	3	15	1		8	64	430	400, 420
Ventilation, Accounts, Valuation	3	15	6	4		68	452	451
Mine Plant Design	2	15			6	72	461	101, 102, 105
Economic Geology	3	15	6	3		53	407	405, 406
Contracts and Specifications	1	15	2	1		73	496	
Thesis	3				3	72	465	400, 420

TIME TABLE.
CIVIL ENGINEERING.

THIRD AND FOURTH YEARS. FIRST SEMESTER.

Hour	9—10	10—11	11—12	12—1
Monday	Mechanics of Engineering.	R. R. Location.	Masonry Const.	Roofs and Bridges.
Tuesday	Mechanics of Engineering.	R. R. Location.	Masonry Const.	Roofs and Bridges.
Wednesday	Mechanics of Engineering.	R. R. Location.	Masonry Const.	Roofs and Bridges.
Thursday	Mechanics of Engineering.	R. R. Location.	Masonry Const.	Roofs and Bridges.
Friday	Mechanics of Engineering.	R. R. Location.	Masonry Const.	Roofs and Bridges.
Saturday				

THIRD AND FOURTH YEARS. SECOND SEMESTER.

Hour	9—10	10—11	11—12	12—1
Monday	Mechanics of Engineering.	Theoretical Hydraulics.	Hydraulic Engineering.	Sewerage.
Tuesday	Mechanics of Engineering.	Theoretical Hydraulics.	Hydraulic Engineering.	Sewerage.
Wednesday	Mechanics of Engineering.	Theoretical Hydraulics.	Hydraulic Engineering.	Sewerage.
Thursday	Mechanics of Engineering.	Theoretical Hydraulics.	Hydraulic Engineering.	Sewerage.
Friday	Mechanics of Engineering.	Theoretical Hydraulics.	Hydraulic Engineering.	Sewerage.
Saturday				

TIME TABLE.

MECHANICAL AND ELECTRICAL ENGINEERING.

THIRD YEAR — FIRST SEMESTER

Hour	9—10	10—11	11—12	12—1
Monday	Mechanics of Engineering.	Electrical Eng. and Min. Eng.	Electrical Machinery.	Thermodynamics.
Tuesday	Mechanics of Engineering.	Kinematics of Machines.	Electrical Abstracts.	Thermodynamics.
Wed.	Mechanics of Engineering.	Electrical Eng. and Min. Eng.	Electrical Machinery,	Thermodynamics.
Thurs.	Mechanics of Engineering.	Kinematics of Machines.	Electrical Machinery.	Thermodynamics.
Friday	Mechanics of Engineering.	Electrical Eng. and Min. Eng.	Kinematics of Machines.	Thermodynamics.
Saturday				

THIRD YEAR — SECOND SEMESTER

Hour	9—10	10—11	11—12	12—1
Monday	Mechanics of Engineering.	Theoretical Hydraulics.		
Tuesday	Mechanics of Engineering.	Theoretical Hydraulics.	Electrical Machinery.	Thermodynamics.
Wed.	Mechanics of Engineering.	Theoretical Hydraulics.	Electrical Machinery.	Electrical Abstracts.
Thurs.	Mechanics of Engineering.	Theoretical Hydraulics.	Machine Design.	Machine Design.
Friday	Mechanics of Engineering.	Theoretical Hydraulics.	Electrical Machinery.	Thermodynamics.
Saturday				

TIME TABLE.

THIRD AND FOURTH YEARS. MINING ENGINEERING. FIRST SEMESTER

DAYS OF WEEK	9—10	10—11	11—12	12—1
Mon.	Theoretical Mechanics, 15 weeks. Metallurgy of Iron and Steel 9 weeks. Mill Construction, 6 weeks.	Electrical Engineering. Principles of Metallurgy.	Economic Geology.	Theromdynamics Ore Dressing.
Tues.	Theoretical Mechahics, 15 weeks. Metallurgy of Iron and Steel 9 weeks. Mill Construction, 6 weeks.	Applied Geology. Exploitation.	Exploitation.	Thermodynamics.
Wed.	Theoretical Mechanics, 15 weeks. Metallurgy of Iron and Steel 9 weeks. Mill Construction, 6 weeks.	Miners' Electrical Eng. Principles of Metallurgy.	Economic Geology.	Thermodynamics. Ore Dressing.
Thurs.	Theoretical Mechanics, 15 weeks. Metallurgical Laboratory.	Applied Geology. Metallurgical Laboratory.	Metallurgical Laboratory. Quantitative Analysis.	Thermodynamics. Metallurgical Laboratory.
Fri.	Theoretical Mechanics, 15 weeks. Metallurgy of Iron and Steel 9 weeks. Mill Construction, 6 weeks.	Electrical Engineering. Principles of Metallurgy.	Economic Geology. Military Science.	Thermodynamics. Ore Dressing.
Sat.	Mill Construction. Geological Excursion.	Geological Excursion Exploitation.	Geological Excursion.	Geological Excursion.

TIME TABLE.

THIRD AND FOURTH YEARS. MINING ENGINEERING. 2ND SEMESTER

	9—10	10—11	11—12	12—1
Monday	Mechanics of Materials, 9 weeks Graphic Statics, 6 weeks Economic Geology,	Theoretical Hydraulics, 9 weeks Coal Mining, 6 weeks Exploration and Excavation 9 weeks Mineralogy, 6 weeks	Contracts and Specifications, 3 weeks Ventilation and Valuation, 12 weeks	Non-Ferrous Metallurgy,
Tuesday	Mechanics of Materials, 9 weeks Graphic Statics, 6 weeks	Theoretical Hydraulics, 9 weeks Coal Mining, 6 weeks Exploration and Excavation 9 weeks Mineralogy,	Contracts and Specifications, 3 weeks Ventilation and Valuation, 12 weeks.	Steam Machinery.
Wednesday	Mechanics of Materials 9 weeks Graphic Statics, 6 weeks Economic Geology,	Theoretical Hydraulics, 9 weeks Coal Mining, 6 weeks Exploration and Excavation 9 weeks Mineralogy, 6 weeks	Contracts and Specifications, 3 weeks. Ventilation and Valuation 12 weeks.	Non-Ferrous Metallurgy.
Thursday	Mechanics of Materials, 9 weeks Graphic Statics, 6 weeks Metallurgical Laboratory,	Metallurgical Laboratory, Exploration and Excavation 9 weeks	Contracts and Specifications, 3 weeks. Metallurgical Laboratory.	Metallurgical Laboratory. Non-Ferrous Metallurgy.
Friday	Mechanics of Materials, 9 weeks Graphic Statics, 6 weeks Economic Geology.	Theoretical Hydraulics, 9 weeks Coal Mining, 6 weeks Exploration and Excavation 9 weeks Military Science, Mineralogy, 6 weeks	Contracts and Specifications, 3 weeks. Ventilation and Valuation, 12 weeks.	Steam Machinery.
Saturday	Thesis. Quanitative Analysis.	Theoretical Hydraulics, 9 weeks. Coal Mining, 6 weeks. Mineralogy 6 weeks.	Thesis. Quanitative Analysis.	Thesis. Quanitative Analysis.

TIME TABLE.

THIRD AND FOURTH YEAR. CIVIL, ELECTRICAL, MECHANICAL AND MINING ENGINEERS FIRST SEMESTER.

	2–3	3–4	4–5	5–530	530–6
Monday	Quant. Anal. Surveying and Drafting....15 wks. Materials Testing..15 " Machine Design....15 "	Quant. Anal. Surveying and Drafting.....15 wks. Drafting .....15 " Materials Testing...15 " Machine Design....15 "	Quan. Anal Surveying and Drafting..... ....15 wks. Materials Testing...15 " Machine Design.....15 "		
Tuesday	Surveying and Drafting. .....15 " R.R Structures..... 7½ " Water Supply Design .....7½ " Electric Lab. Mine Surveying .....15 "	Surveying and Drafting.....15 " R. R. Structures... 7½ " Water Supply Design 7½ " Electric Lab. Mine Surveying.....15 "	Surveying and Drafting .....15 " R.R. Structures.... 7½ " Water Supply De ign 7½ " Mine Surveying.....15 "	Mine Surveying.15 wks.	Mine Surveying 15 wks
Wed.	Surveying and Drafting.....15 " R.R. Structures.... 7½ " Water Supply Design ..... 7½ " Machine Design.....15 " Quant. Anal. Mine Plant Design..15 "	Surveying and Drafting..... .....15 " R.R. Structures.... 7½ " Water Supply and Design..... 7½ " Machine Design....15 " Quant. Anal. Mine Plant Design..15 "	Surveying and Drafting.....15 " R.R. Structures....15 " Water Supply and Design..... 7½ " Machine Design....15 " Quan. Anal. Mine Plant Design.. 5 "	Military and Physical Drill.....15 "	
Thurs.	Roofs and Bridges..15 " Machine Lab.....15 " Metall. Lab.....15 "	Roof and Bridges...15 " Mech. Lab.....15 " Metall. Lab.....15 "	Roofs and Bridges..15 " Mech. Lab.....15 " Metall. Lab.....15 "		
Friday	Roofs and Bridges..15 " Quant. Anal. Mine Plant Design..15 "	Roofs and Bridges..15 " Quant. Anal. Mine Plant Design ..15 "	Roofs and Bridges..15 " Quant. Anal. Mine Plant Design..15 "	Military and Physical Drill.....15 "	

TIME TABLE.

CIVIL, ELECTRICAL, MECHANICAL, AND MINING ENGINEERING.

THIRD AND FOURTH YEARS. SECOND SEMESTER.

	2—3	3—4	4—5	5—5.30	5.30 6
Monday	Materials Testing....15 wks. Masonry Design..... 4 " Bridge Design..... 7 " Sewer Design ..... 2 " Quantitative Anal....15 " Mining Thesis .... ..15 "	Materials Testing.....15 wks. Masonry Design.... . 4 " Bridge Design ..... 9 " Sewer Design . ..... 2 " Quan. Analysis..... ...15 " Mining Thesis.... .. 15 "	Material Testing.....15 wks. Masonry Design..... 4 " Bridge Design..... 9 " Sewer Design ..... 2 " Quant. Anal .....15 " Mining Thesis..... 15 "		
Tuesday	Hydraulic Testing ...15 wks. Assaying.... .....15 " Masonry Design..... 5 " Bridge Design..... 9 " Sewer Design..... 2 "	Hydraulic Testing....15 wks. Assaying..... .....15 " Masonry Design..... 4 " Bridge Design..... 9 " Sewer Design..... 2 "	Hydraulic Testing....15 wks. Assaying .....15 " Masonry Design..... 4 " Bridge Design..... 9 " Sewer Design..... 2 "		
Wed.	Quantitative Anal....15 wks. Mine Plant Design. ..15 " Masonry Design..... 9 " Bridge Design ..... 9 " Sewer Design..... 2 "	Quant. Anal..... ....15 " Mine Plant Design....15 " Masonry Design..... 4 " Bridge Design..... .. 9 " Sewer Design..... 2 "	Quant. Anal.....15 wks. Mine Plant Design....15 " Masonry Design..... 4 " Bridge Design..... 9 " Sewer Design..... 2 "	Military and Physical Drill. 15 wks.	
Thurs.	Masonry Design..... 4 wks Bridge Design..... 9 " Sewer Design..... 2 " Metallurgical Lab....15 " Mechanical Lab.....15 "	Masonry Design..... 4 wks. Bridge Design..... 9 " Sewer Design..... 2 " Metall. Lab..... 15 " Mech. Lab.....15 "	Masonry Design..... 4 wks. Bridge Design..... 9 " Sewer Design... . ... 2 " Metall. Lab.....15 " Mech. Lab.....15 "		
Friday	Assaying.....15 wks. Mine Plant Design.... Mining Thesis ..... Masonry Design... .. 4 wks Bridge Design..... 9 " Sewer Design..... 2 "	Assaying .. ..15 wks. Mine Plant Design.... Mining Thesis..... Masonry Design..... 4 wks. Bridge Design..... 9 " Sewer Design..... 2 "	Assaying.....15 wks. Mine Plant Design.... Mining Thesis..... Masonry Design..... 4 wks. Bridge Design.... ... 9 " Sewer Design..... 2 "	Military and Physical Drill 15 wks.	